

E1/E20 Emulator

Additional Document for User's Manual
(RX User System Design)

Supported Devices:
RX Family

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Terminology

Some specific words used in this user's manual are defined below.

Host machine

This means a personal computer used to control the emulator.

User system

This means a user's application system in which the MCU to be debugged is used.

User program

This means the program to be debugged.

Programming Software

In this document, this indicates the Flash Development Toolkit or Renesas Flash Programmer that can be used with the E1 or E20.

"#" at the end of a pin name (signal name)

"#" at the end of a pin name (signal name) indicates that the pin (signal) is active low (e.g., TRST#).

1. Overview

1.1. Overview of E1 and E20 Emulators

The E1 and E20 are on-chip debugging emulators for Renesas's mainstream MCUs.

The E1 emulator is a highly affordable development tool providing basic debugging functions. The E20 emulator is a development tool allowing sophisticated debugging through enhanced functions such as tracing and RAM monitoring as well as the basic debugging functions of the E1. The E1 and E20 emulators can also serve as a Flash Programmer.

1.2. Notes on Using E20 Emulator

To use the large trace function and the realtime RAM monitoring function, which are the primary features of the E20 emulator, the target MCU must be equipped with a pin for outputting trace information. Currently such MCUs are the RX600 series MCUs in packages that have more than 100 pins. For other MCUs, the available functions are equivalent to those of the E1 emulator (only the internal trace function in the MCU and memory reference and modification during execution).

When using the E20 emulator with the 38-pin to 14-pin conversion adapter (R0E000200CKA00) that is bundled with the E20, the large trace function and realtime RAM monitoring function are not available with any MCU.

The available functions are equivalent to those of the E1 emulator (only the internal trace function in the MCU and memory reference and modification during execution).

When you need to use the large trace function or realtime RAM monitoring function with an RX600 series MCU in a package that has 100 pins or less, use the separately available debug MCU board.

1.3. Configuration of E1/E20 Emulator Manuals

The E1/E20 manual consists of multiple parts: the E1/E20 Emulator User's Manual and the additional documents for the user's manual for each MCU.

Be sure to read each part before using the E1/E20 emulator.

(1) E1/E20 emulator user's manual

The E1/E20 emulator user's manual has the following contents:

- Components of the emulators
- Emulator hardware specification
- Connection to the emulator and the host machine and user system

(2) E1/E20 Additional Documents for User's Manual (RX User System Design)

The E1/E20 Additional Documents for User's Manual (RX User System Design) describes information necessary for hardware design such as connection examples and interface circuits.

(3) User's Manual and Help of Emulator Debugger

User's Manual and Help of Emulator Debugger describes the functions of the E1/E20 Emulator Debugger and the operating instructions.

- CubeSuite+ Integrated Development Environment User's Manual: RX Debug
- Help for e2 studio
- E1/E20 Emulator Additional Document for User's Manual (High-performance Embedded Workshop RX Debug)

1.4. Supported Devices

Supported Device List of RX E1/E20 Debugger

Device groups / groups	E1 Emulator		E20 Emulator	
	JTAG I/F	FINE I/F	JTAG I/F	FINE I/F※
RX610, RX621, RX62N, RX62T, RX62G	✓	—	✓	—
RX63x, RX64x	✓	✓	✓	✓
RX200 Series	—	✓	—	✓
RX100 Series	—	✓	—	✓

- * The large trace function and realtime RAM monitoring function are not available with any MCU.
The available functions are equivalent to those of the E1 emulator (only the internal trace function in the MCU and memory reference and modification during execution).

2. Designing the User System

2.1. Connecting the E1/E20 Emulator with the User System

To connect the E1 or E20 emulator (hereinafter referred to as the emulator), a connector for the user system interface cable must be mounted on the user system.

When designing the user system, read this section of this manual and the hardware manual for the MCUs.

Table 2.1 shows the type numbers of the E1 and E20 emulators.

Table 2.1 Type Numbers, Trace Pin Functions, and Connector Types

Emulator Type	Type Number	Connector	Communication interface	External Trace-Output Functions
E1	R0E000010KCE00	14-pin type	JTAG, FINE	Not available
E20	R0E000200KCT00	14-pin type *1	JTAG, FINE	Not available
		38-pin type	JTAG	Available

Notes: 1. 38-pin to 14-pin conversion adapter is also required

There are two types of connector, one with 14 and the other with 38 pins. Use the connector that corresponds to the aims of emulation. To use the external trace-output function, which is capable of obtaining large amounts of trace data in real-time, the 38-pin type connector is required.

(1) 14-pin type (external trace-output function is not available)

This connector only supports basic functions using JTAG Interface Connection and FINE interface connection and do not employ the external trace-output function intended for the acquisition of large amounts of trace data by the external trace-output function. These connectors are general-purpose connectors with a pitch of 2.54 mm.

(2) 38-pin type (external trace-output function is available)

This connector supports basic functions that employ JTAG Interface Connection, and the external trace-output function for acquiring large amounts of trace data in real-time. This connector is as compact as the 14-pin connectors.

2.2. Installing the Connector on the User System

Table 2.2 shows the recommended connectors for the E1 and E20 emulators.

Table 2.2 Recommended Connectors

Connector	Type Number	Manufacturer	Specifications
14-pin connector	7614-6002	Sumitomo 3M Limited	14-pin straight type (Japan)
	2514-6002	3M Limited	14-pin straight type (other countries)
38-pin connector	2-5767004-2	Tyco Electronics Japan G.K.	38-pin type

2.2.1. Connecting the User System Interface Cable to the 14-Pin Connector

Figure 2.1 show an example of the connection between a user system interface cable of the 14-pin type and an E1. Figure 2.2 show an example of connection of the cable with the 14-pin connector to the E20 via the 38-pin to 14-pin conversion adapter.

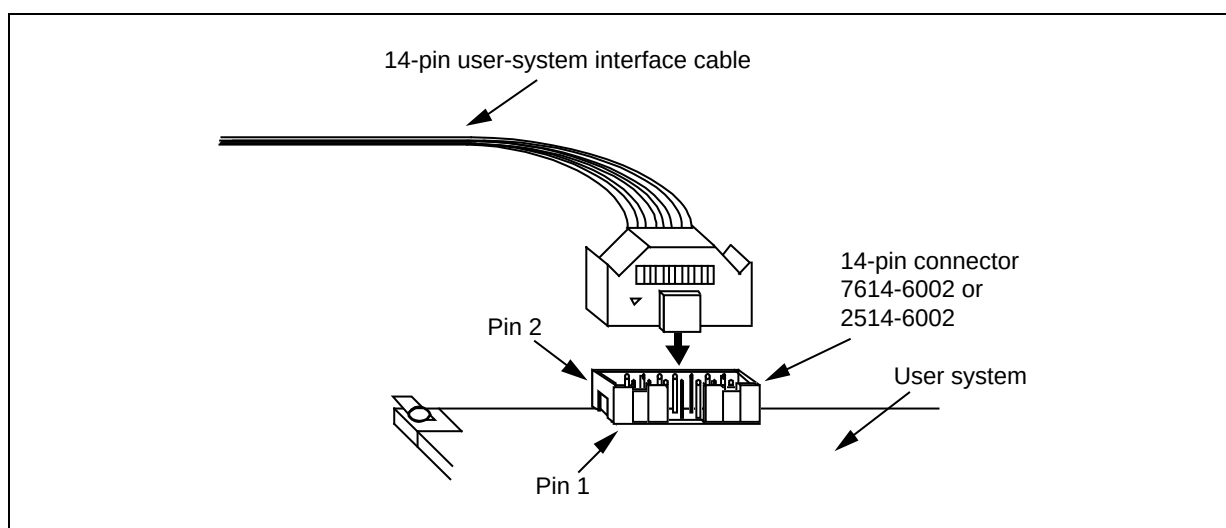


Figure 2.1 Connecting the User System Interface Cable to the 14-Pin Connector of the E1 Emulator

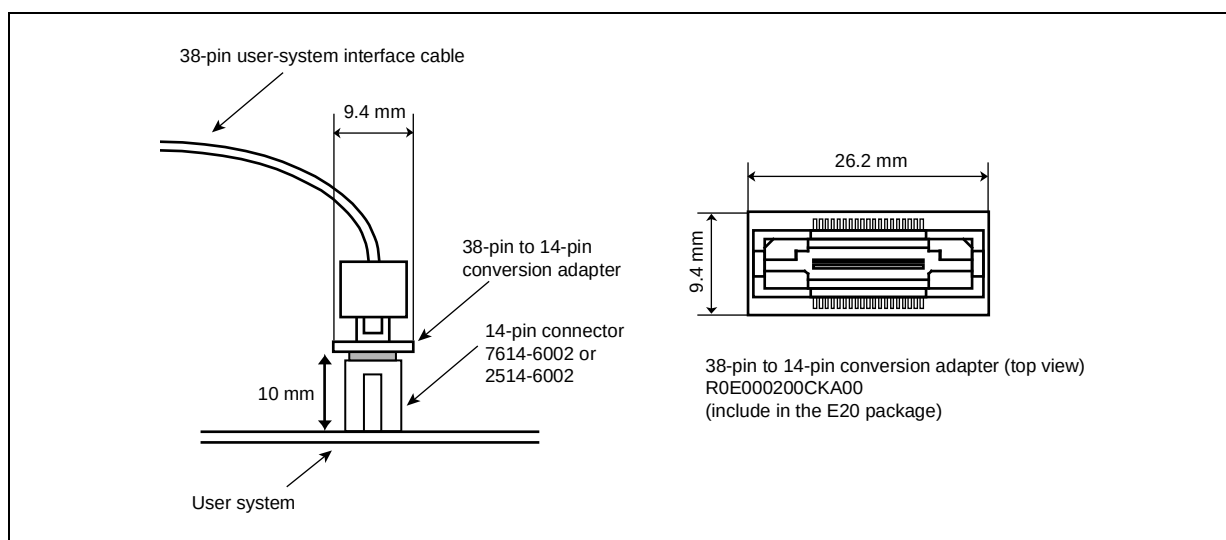


Figure 2.2 Connecting the User System Interface Cable to the 14-Pin Connector of the E20 Emulator

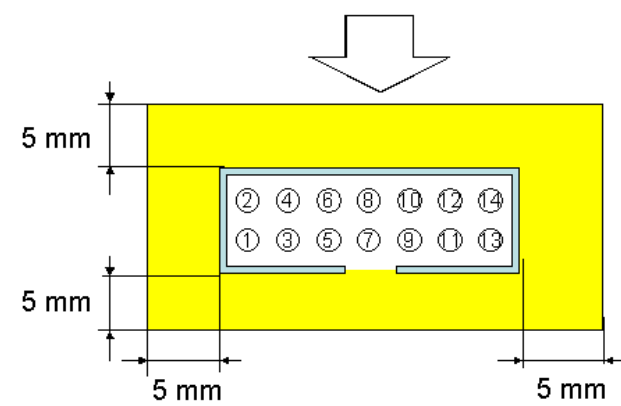

CAUTION

Limit to the height on connector periphery:

 For a case where the R0E000200CKA00 is used for connecting the E20 emulator to a 14-pin connector, do not mount other components with a height of 10 mm or more within 5 mm of the connector on the user system.

Type number: 7614-6002 (manufactured by Sumitomo 3M Ltd.)
2514-6002 (manufactured by 3M Ltd.)

The emulator is connected from this direction.



 Area with limit on mounted components
(heights must be no greater than 10 mm)

2.2.2. Connecting the User System Interface Cable to the 38-Pin Connector

When designing the layout of a user board with a 38-pin connector, reduce cross-talk noise etc. by keeping other signal lines out of the region where the connector is situated.

As shown in Figure 2.3, an upper limit (5 mm) applies to the heights of other components mounted around the connector (labeled "Area with limit on mounted components") in the figure.

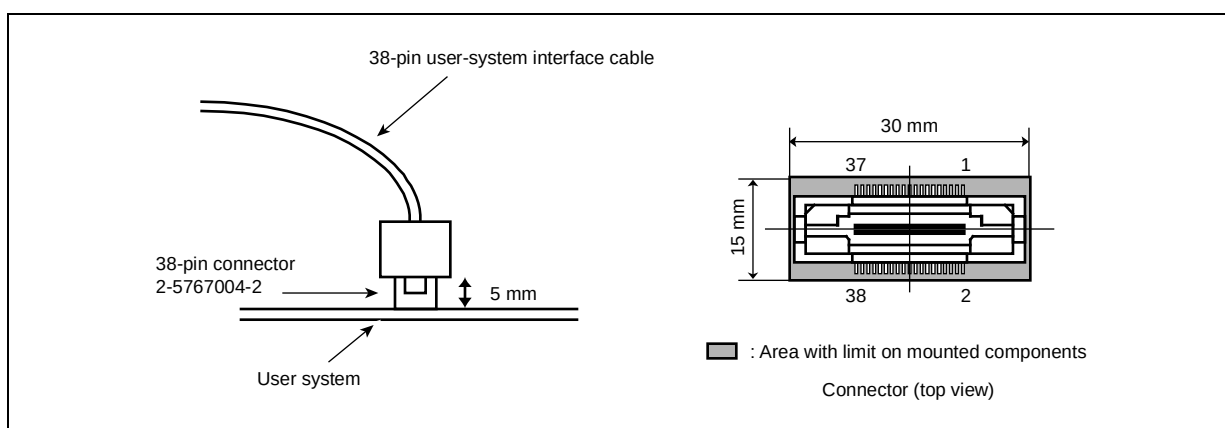


Figure 2.3 Connecting the User System Interface Cable to the 38-Pin Connector of the E20 Emulator

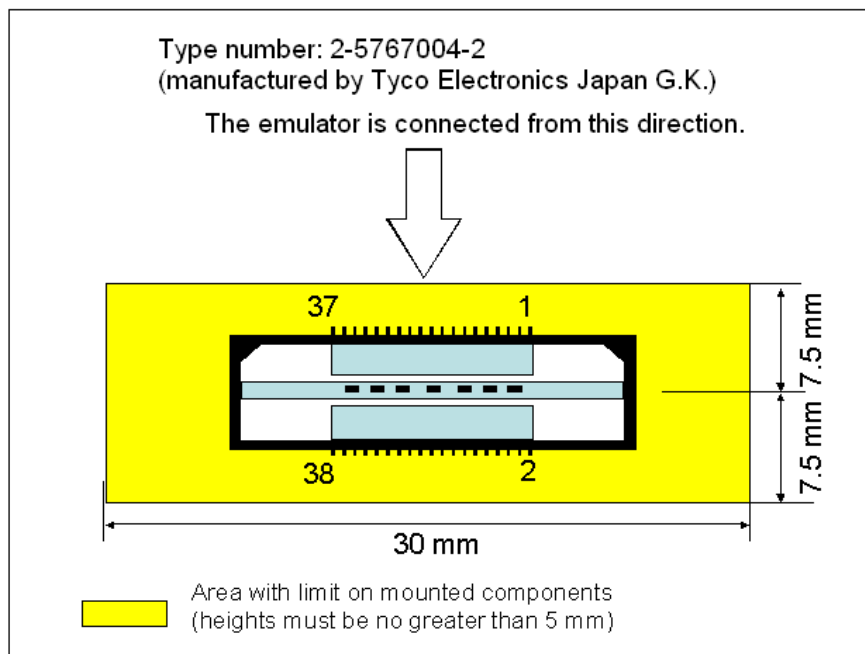
! CAUTION

Limit to the height on connector periphery:



For a case where the E20 emulator is connected to a 38-pin connector:

When designing the layout of a user board with a 38-pin connector, reduce cross-talk noise etc. by keeping other signal lines out of the region where the connector is situated. As shown in Figure 2.5, an upper limit (5 mm) applies to the heights of components mounted around the connector on the user system (indicated by "area with limit on mounted components" in the figure).



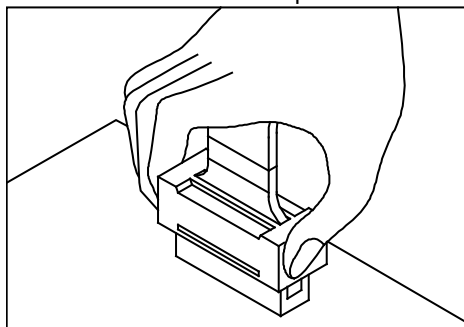
! CAUTION

Notes on connector insertion and removal:

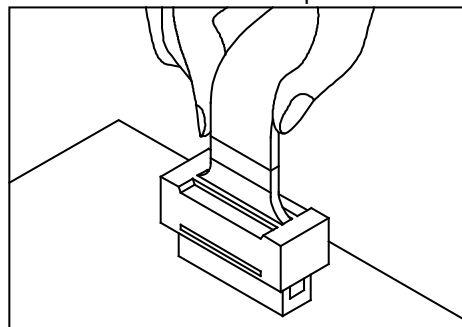


When connecting or disconnecting the user-system interface cable and the emulator or user system, grasp the connector cover at the end of the cable. Pulling the cable itself will damage the wiring. Also, be aware that the user-system interface cable has the direction in which it must be inserted. If the cable is connected in the wrong direction, it may be damaged.

Correct example



Incorrect example



2.3. Pin Assignments of the Connector on the User System

2.3.1. 14-Pin Connector Specifications

Figure 2.4 shows the specifications of the 14-pin connector.

Tables 2.3 and 2.4 on the following pages show the pin assignments differing with each MCU group in JTAG Interface Connection and FINE Interface Connection.

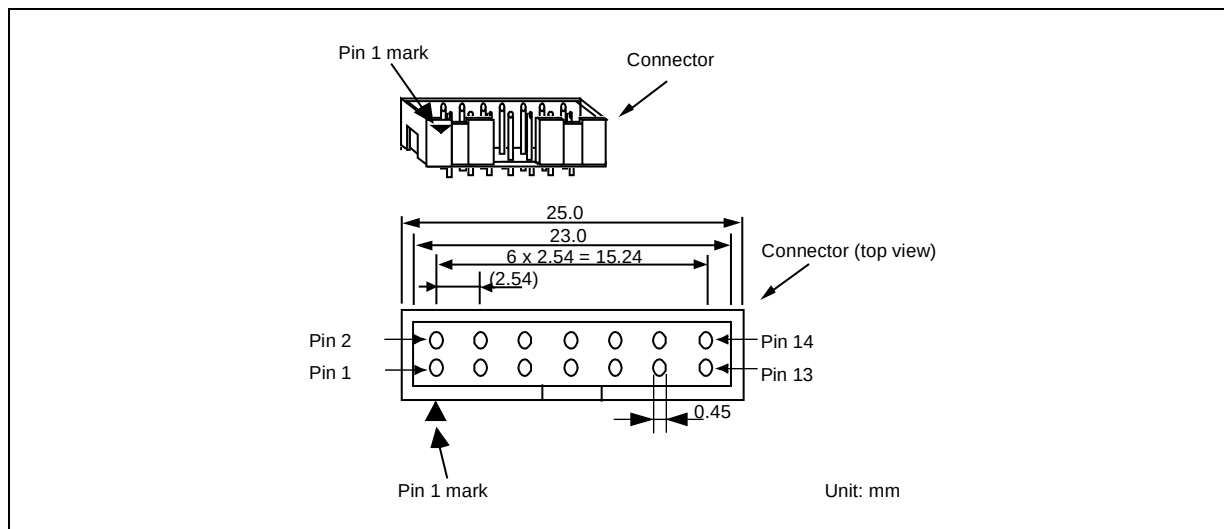


Figure 2.4 Emulator Connector Specifications (14 Pin)

Table 2.3 14-Pin Connector Pin Assignments Differing with Each MCU Group in JTAG Interface Connection

Pin No.	RX610, RX621, RX62N, RX62T and RX62G Groups		RX63x and RX64x Groups		Note
	Signal *1 *2	Direction *3	Signal *2	Direction *3	
1	TCK	Input	TCK	Input	Communication clock
2	GND *4	–	GND *4	–	GND
3	TRST#	Input	TRST#	Input	
4	(EMLE) *5	I/O	(EMLE) *5	I/O	
5	TDO	Output	TDO	Output	
6	NC	–	NC	–	Not connected
7	(MD1) *6	I/O	(MD) *6	I/O	Operation mode
8	VCC	–	VCC	–	Power supply
9	TMS	Input	TMS	Input	
10	(MD0) *6	I/O	(UB) *7	I/O	Operation mode
11	TDI	Input	TDI	Input	
12	GND *4	–	GND *4	–	GND
13	RES#	I/O	RES#	I/O	User system reset
14	GND *4	–	GND *4	–	Checking connection to user system

- Notes:
- When writing to the MCUs of the RX610, RX62T, and RX62G (112-pin version) Groups using the Flash Development Toolkit or the Renesas Flash Programmer, be aware that the pin assignments of the 14-pin connector differ than otherwise.
For details on the programming software, refer to http://www.renesas.com/products/tools/flash_prom_programming/.
 - These are the names of the MCU pins at the time the E1 or E20 is connected (i.e. during debugging).
 - Input to or output from the user system.
 - Securely connect pins 2, 12, and 14 of the connector to GND on the user system. These pins are used as electrical GND and for the E1 or E20 to monitor connection to the user system.
 - The EMLE pin can operate even if it is not connected to the E1 or E20 emulator. When the pin is not connected to the E1 or E20 emulator, a special circuit for the pin must be configured on the user system.
If the MCU does not have an EMLE pin, it is not necessary to connect it to the emulator connector. In this case, only FINE Interface Connection is available.
 - The MD0, MD1, or MD pin can operate even if it is not connected to the E1 or E20 emulator. When the pin is not connected to the E1 or E20 emulator, a special circuit for the pin must be configured on the user system.
The MD pin must be connected to debug a ROM-less product of the RX631 Group.
You cannot debug a program in boot mode.
 - The UB pin is a port for the entry to the user boot mode. Which port is the UB pin depends on the MCU. Refer to the section on operation modes in the hardware manual of the MCU to be used.
The UB pin can operate even if it is not connected to the E1 or E20 emulator. When the pin is not connected to the E1 or E20 emulator, a special circuit for the pin must be configured on the user system.
Connection is not necessary if the MCU does not support the user boot mode.

Table 2.4 14-Pin Connector Pin Assignments Differing with Each MCU Group in FINE Interface Connection

Pin No.	RX63x and RX64x Groups		RX200 Series RX100 Series		Note
	Signal *1	Direction *2	Signal *1	Direction *2	
1	FINEC *6	Input	NC *7	Input	Communication clock
2	GND *3	—	GND *3	—	GND
3	NC	—	NC	—	Not connected
4	(EMLE) *4	I/O	NC	—	
5	(TxD1) *8	Output	(TxD1) *8	Output	Communication data for Flash Programmer
6	NC	—	NC	—	Not connected
7	MD/FINED *6	I/O	MD/FINED *7	I/O	Operation mode / Communication data
8	VCC	—	VCC	—	Power supply
9	NC	—	NC	—	Not connected
10	(UB) *5	I/O	(UB) *5	I/O	Operation mode
11	(RxD1) *8	Input	(RxD1) *8	Input	Communication data for Flash Programmer
12	GND *3	—	GND *3	—	GND
13	RES#	I/O	RES#	I/O	User system reset
14	GND *3	—	GND *3	—	Checking connection to user system

- Notes:
- These are the names of the MCU pins at the time the E1 or E20 is connected (i.e. during debugging).
 - Input to or output from the user system.
 - Securely connect pins 2, 12, and 14 of the connector to GND on the user system. These pins are used as electrical GND and for the E1 or E20 to monitor connection to the user system.
 - The EMLE pin can operate even if it is not connected to the E1 or E20 emulator. When the pin is not connected to the E1 or E20 emulator, a special circuit for the pin must be configured on the user system.
If the MCU does not have an EMLE pin, it is not necessary to connect it to the emulator connector. In this case, only FINE Interface Connection is available.
 - The UB pin is a port for the entry to the user boot mode. Which port is the UB pin depends on the MCU. Refer to the section on operation modes in the hardware manual of the MCU to be used.
The UB pin can operate even if it is not connected to the E1 or E20 emulator. When the pin is not connected to the E1 or E20 emulator, a special circuit for the pin must be configured on the user system.
Connection is not necessary if the MCU does not support the user boot mode.
 - For the RX630, RX631, RX63N, and RX63T Groups, FINE interface only supports a 2-wire system using FINEC and MD/FINED pins.
The FINEC and MD/FINED pins are exclusively used by the E1 or E20 emulator. Any functions that are multiplexed on the FINEC pin are not available.
For the RX64x Group, FINE interface supports a 1-wire system using the MD/FINED pin.
Only the MD/FINED pin is exclusively used by the E1 or E20 emulator. It is not necessary to connect the FINEC pin since this pin is not used. The FINEC pin can be used as a port.
 - For the RX200 Series and RX100 Series, FINE interface supports a 1-wire system using the MD/FINED pin.
Only the MD/FINED pin is exclusively used by the E1 or E20 emulator. It is not necessary to connect the FINEC pin since this pin is not used. The FINEC pin can be used as a port.
 - The RxD1 and TxD1 pins are necessary when writing to flash memory via SCI. Connection is not necessary when writing via FINE or when debugging.
When debugging, the RxD1 and TxD1 pins on the emulator enter a HiZ state. If the MCU has multiple RxD1 or TxD1 pins, confirm which one of the respective pins is used in boot mode in the hardware manual of the MCU.

2.3.2. 38-Pin Connector Specifications

Figure 2.5 shows the specifications of the 38-pin connector. Table 2.5 shows the 38-connector pin assignments when connecting to the RX610, RX621, RX62N, RX62T, and RX62G Groups in JTAG Interface Connection. Table 2.6 shows the 38-connector pin assignments when connecting to the RX63x and RX64x Groups in JTAG Interface Connection.

In FINE Interface Connection, use the 38-pin to 14-pin conversion adapter included with the E20 to connect the emulator to the 14-pin connector.

Note that with the packages of the RX610, RX621, RX62N, RX62T, and RX62G Groups which do not have a trace pin, the function to acquire large amounts of trace data is not available. In such case, use a 14-pin connector.

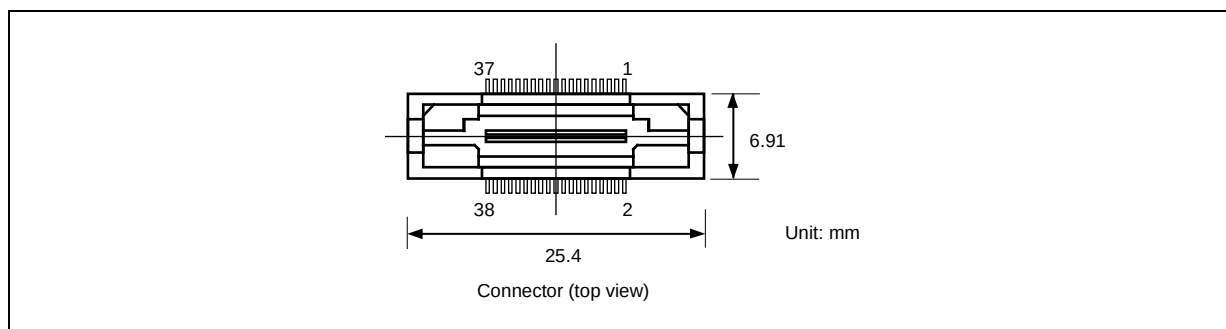


Figure 2.5 Emulator Connector Specifications (38-Pin)

The GND bus lead at the center of the 38-pin connector must be grounded.

Table 2.5 38-Pin Connector Pin Assignments in JTAG Interface Connection (for RX610, RX621, RX62N, RX62T and RX62G Groups)

Pin No.	Signal *1	Direction *2	Note	Pin No.	Signal *1	Direction *2	Note
1	NC	—	Not connected	2	(MD0) *5	I/O	Operation mode
3	(EMLE) *4	I/O		4	NC	—	Not connected
5	GND *3	—	Checking connection to user system	6	TRCLK	Output	
7	NC	—	Not connected	8	(MD1) *5	I/O	Operation mode
9	RES#	I/O	User system reset	10	NC	—	Not connected
11	TDO	Output		12	VCC	—	Power supply
13	NC	—	Not connected	14	VCC	—	Power supply
15	TCK	Input	Communication clock	16	NC	—	Not connected
17	TMS	Input		18	NC	—	Not connected
19	TDI	Input		20	NC	—	Not connected
21	TRST#	Input		22	NC	—	Not connected
23	NC	—	Not connected	24	TRDATA3	Output	
25	NC	—	Not connected	26	TRDATA2	Output	
27	NC	—	Not connected	28	TRDATA1	Output	
29	NC	—	Not connected	30	TRDATA0	Output	
31	NC	—	Not connected	32	TRSYNC	Output	
33	NC	—	Not connected	34	NC	—	Not connected
35	NC	—	Not connected	36	NC	—	Not connected
37	NC	—	Not connected	38	NC	—	Not connected

- Notes:
- These are the names of the MCU pins at the time the E1 or E20 is connected (i.e. during debugging).
 - Input to or output from the user system.
 - Securely connect pin 5 and the GND bus lead of the connector to GND on the user system. These are used as electrical GND and for the E1 or E20 to monitor connection to the user system.
 - The EMLE pin can operate even if it is not connected to the E1 or E20 emulator. When the pin is not connected to the E1 or E20 emulator, a special circuit for the pin must be configured on the user system.
If the MCU does not have an EMLE pin, it is not necessary to connect it to the emulator connector. In this case, only FINE Interface Connection is available.
 - The MD0 and MD1 pin can operate even if it is not connected to the E1 or E20 emulator. When the pin is not connected to the E1 or E20 emulator, a special circuit for the pin must be configured on the user system.
You cannot debug a program in boot mode.

Table 2.6 38-Pin Connector Pin Assignments in JTAG Interface Connection (for RX63x and RX64x Groups)

Pin No.	Signal *1	Direction *2	Note	Pin No.	Signal *1	Direction *2	Note
1	NC	—	Not connected	2	(UB) *6	I/O	Operation mode
3	(EMLE) *4	I/O		4	NC	—	Not connected
5	GND *3	—	Checking connection to user system	6	TRCLK	Output	
7	NC	—	Not connected	8	(MD) *5	I/O	Operation mode
9	RES#	I/O	User system reset	10	NC	—	Not connected
11	TDO	Output		12	VCC	—	Power supply
13	NC	—	Not connected	14	VCC	—	Power supply
15	TCK	Input	Communication clock	16	NC	—	Not connected
17	TMS	Input		18	NC	—	Not connected
19	TDI	Input		20	NC	—	Not connected
21	TRST#	Input		22	NC	—	Not connected
23	NC	—	Not connected	24	TRDATA3	Output	
25	NC	—	Not connected	26	TRDATA2	Output	
27	NC	—	Not connected	28	TRDATA1	Output	
29	NC	—	Not connected	30	TRDATA0	Output	
31	NC	—	Not connected	32	TRSYNC	Output	
33	NC	—	Not connected	34	NC	—	Not connected
35	NC	—	Not connected	36	NC	—	Not connected
37	NC	—	Not connected	38	NC	—	Not connected

- Notes:
- These are the names of the MCU pins at the time the E1 or E20 is connected (i.e. during debugging).
 - Input to or output from the user system.
 - Securely connect pin 5 and the GND bus lead of the connector to GND on the user system. These are used as electrical GND and for the E1 or E20 to monitor connection to the user system.
 - The EMLE pin can operate even if it is not connected to the E1 or E20 emulator. When the pin is not connected to the E1 or E20 emulator, a special circuit for the pin must be configured on the user system.
If the MCU does not have an EMLE pin, it is not necessary to connect it to the emulator connector. In this case, only FINE Interface Connection is available.
 - The MD pin can operate even if it is not connected to the E1 or E20 emulator. When the pin is not connected to the E1 or E20 emulator, a special circuit for the pin must be configured on the user system.
The MD pin must be connected to debug a ROM-less product of the RX631 Group.
You cannot debug a program in boot mode.
 - The UB pin is a port for the entry to the user boot mode. Which port is the UB pin depends on the MCU. Refer to the section on operation modes in the hardware manual of the MCU to be used.
The UB pin can operate even if it is not connected to the E1 or E20 emulator. When the pin is not connected to the E1 or E20 emulator, a special circuit for the pin must be configured on the user system.
Connection is not necessary if the MCU does not support the user boot mode.

2.4. Recommended Circuit between the Connector and the MCU

This section shows recommended circuits for connection between the connector and the MCU when the E1 or E20 emulator is in use. For processing of signals, refer to section 2.5, Notes on Connection.

2.4.1. JTAG Interface Connection (RX610 Group) between the 14-pin connector

Figure 2.6 shows a recommended circuit for connection between the 14-pin connector and the RX610 Group MCUs in JTAG Interface Connection.

Figure 2.7 shows a recommended circuit for connection between the 14-pin connector and an RX610-group MCU when programming software is used.

For RX610-group MCUs, the pin assignment in the 14-pin connector differs between when debugging is executed and when the flash memory is programmed using programming software. To execute both debugging and flash programming for an RX610-group MCU, two 14-pin connectors are required.

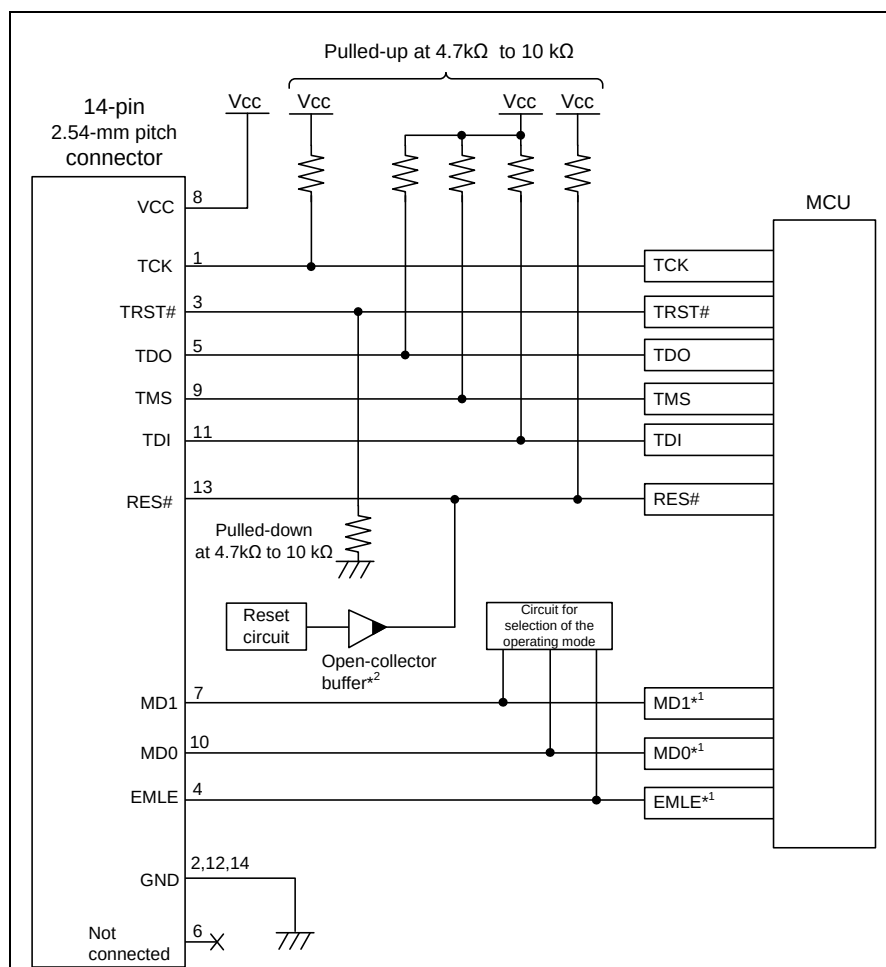


Figure 2.6 Recommended Circuit for Connection between the 14-Pin Connector and the RX610 Group MCUs in JTAG Interface Connection

- Notes:
1. For processing of signals MD0, MD1 and EMLE, refer to section 2.5, Notes on Connection.
 2. The output of the reset circuit of the user system must be open collector.

If the hot plug-in facility is to be used, connection to the emulator must be with the TRST# and EMLE signals for the emulator at the low and high levels, respectively, when power is supplied to the user system (at the time of a system reset). Ensure that a ceramic capacitor (approx. 0.1 μ F) is installed between the RES# pin and GND and the TRST# signal is pulled down, and include circuitry which can switch the EMLE signal to the high or low level.

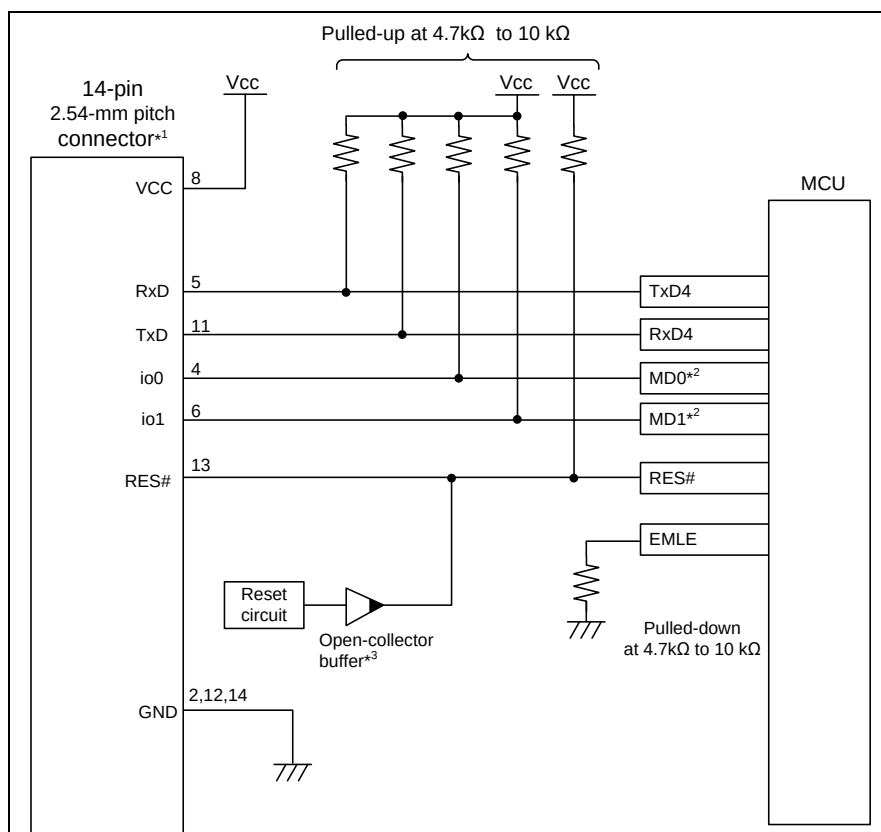


Figure 2.7 Recommended Circuit for Connection between the 14-Pin Connector and the RX610 Group MCUs when programming software is used.

- Notes:
1. Leave open the pins for which no name is shown in the figure for the 14-Pin Connector pin assignment.
 2. For processing of signals MD0 and MD1, refer to section 2.5, Notes on Connection.
 3. The output of the reset circuit of the user system must be open collector.

When writing to the MCUs of the RX610 Group using the Flash Development Toolkit or the Renesas Flash Programmer, be aware that the pin assignments of the 14-pin connector differ than otherwise. For details on the programming software, refer to http://www.renesas.com/products/tools/flash_prom_programming/.

2.4.2. JTAG Interface Connection (RX621, RX62N, RX62T, RX62G Groups) between the 14-pin connector

Figure 2.8 shows a recommended circuit for connection between the 14-pin connector and the RX62T and RX62G Group MCUs in JTAG Interface Connection.

Figure 2.9 shows a recommended circuit for connection between the 14-pin connector and the RX62T and RX62G group MCUs (112-pin version) when programming software is used.

For RX62T and RX62G group MCUs, the pin assignment in the 14-pin connector differs between when debugging is executed and when the flash memory is programmed using programming software. To execute both debugging and flash programming for the RX62T and RX62G group MCUs (112-pin version), two 14-pin connectors are required.

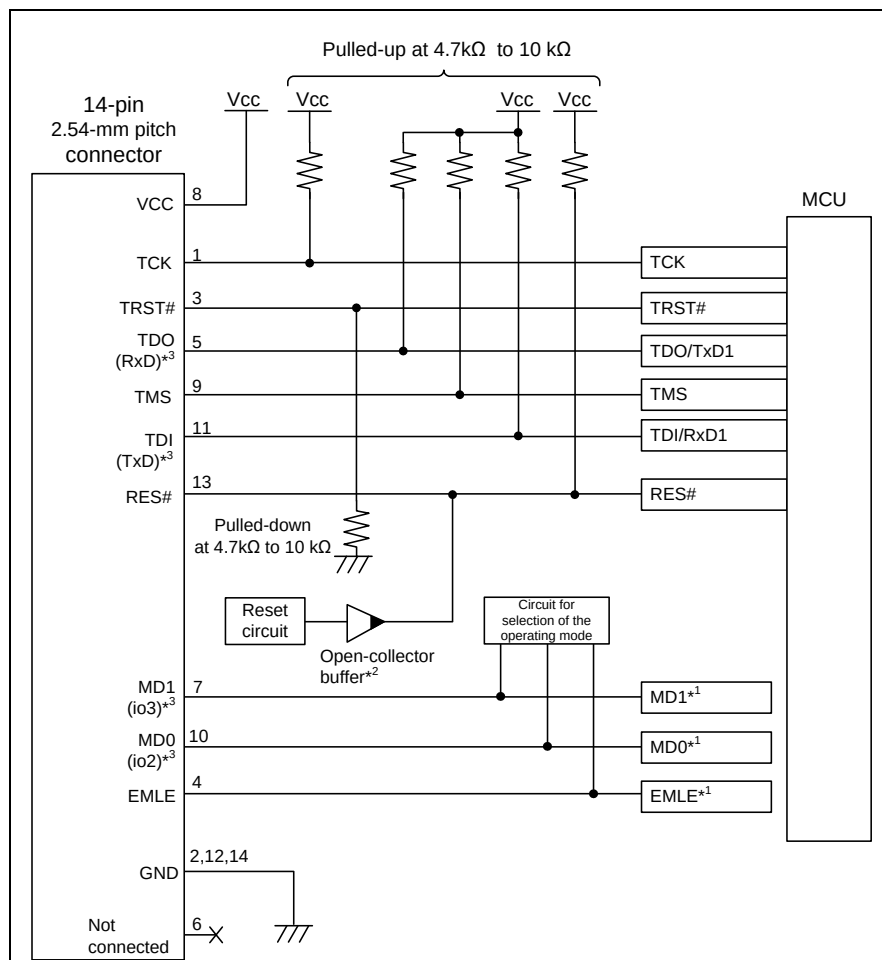


Figure 2.8 Recommended Circuit for Connection between the 14-Pin Connector and the RX621, RX62N, RX62T, RX62G Group MCUs in JTAG Interface Connection

- Notes:
1. For processing of signals MD0, MD1 and EMLE, refer to section 2.5, Notes on Connection.
 2. The output of the reset circuit of the user system must be open collector.
 3. The names in parentheses () are pin names in the E1 and E20 14-pin connector when flash memory is programmed using programming software. When programming flash memory, also connect VCC, GND, and RES#.

If the hot plug-in facility is to be used, connection to the emulator must be with the TRST# and EMLE signals for the emulator at the low and high levels, respectively, when power is supplied to the user system (at the time of a system reset). Ensure that a ceramic capacitor (approx. 0.1 μ F) is installed between the RES# pin and GND and the TRST# signal is pulled down, and include circuitry which can switch the EMLE signal to the high or low level.

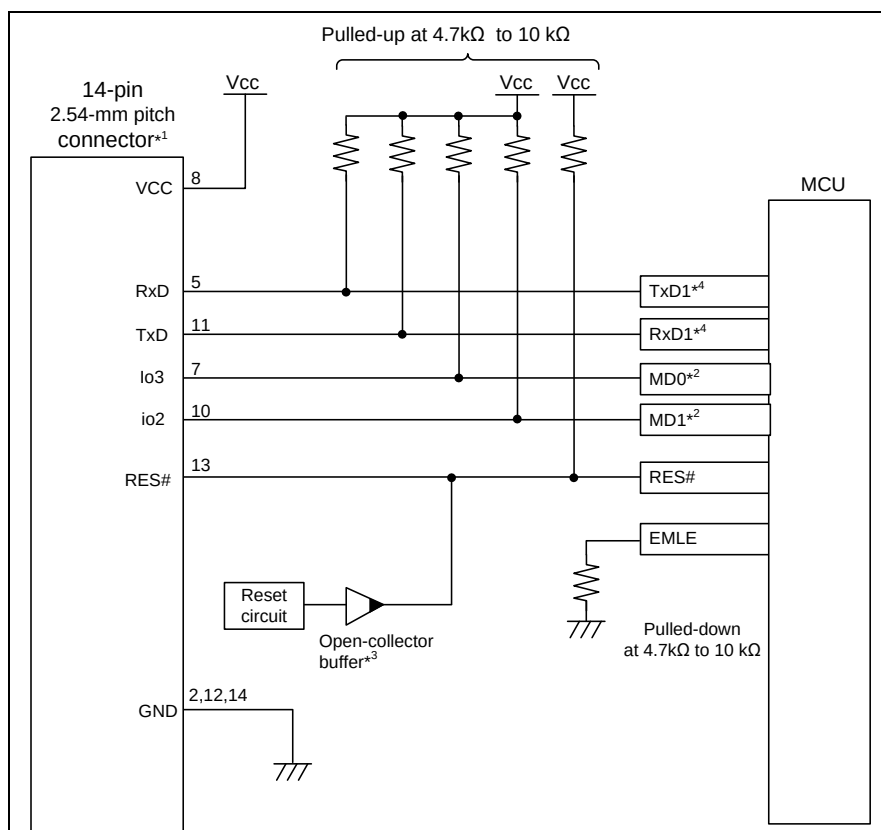


Figure 2.9 Recommended Circuit for Connection between the 14-Pin Connector and the RX62T and RX62G (112-pin version) Group MCUs when programming software is used.

- Notes:
1. Leave open the pins for which no name is shown in the figure for the 14-Pin Connector pin assignment.
 2. For processing of signals MD0, MD1 and EMLE, refer to section 2.5, Notes on Connection.
 3. The output of the reset circuit of the user system must be open collector.
 4. Note that TDO and TxD1, and TDI and RxD1 are assigned to different pins in the RX62T and RX62G (112-pin version) group MCUs.

When writing to the MCUs of the RX62T and RX62G (112-pin version) Group using the Flash Development Toolkit or the Renesas Flash Programmer, be aware that the pin assignments of the 14-pin connector differ than otherwise.

For details on the flash programming software, refer to

http://www.renesas.com/products/tools/flash_prom_programming/.

2.4.3. JTAG Interface Connection (RX63x and RX64x Groups) between the 14-pin connector

Figure 2.10 shows a recommended circuit for connection between the 14-pin connector and the RX63x or RX64x Group MCUs in JTAG Interface Connection.

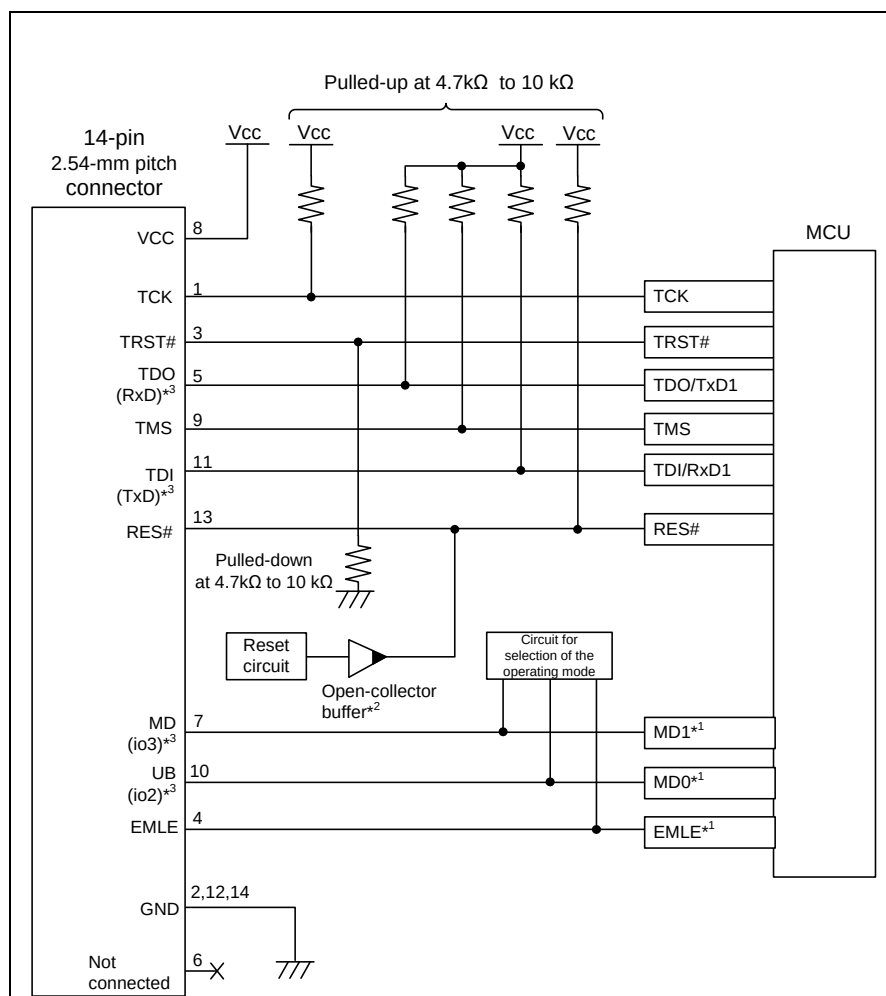


Figure 2.10 Recommended Circuit for Connection between the 14-Pin Connector and the RX63x or RX64x Group MCUs in JTAG Interface Connection

- Notes:
1. For processing of signals MD, UB and EMLE, refer to section 2.5, Notes on Connection.
 2. The output of the reset circuit of the user system must be open collector.
 3. The names in parentheses () are pin names in the E1 and E20 14-pin connector when flash memory is programmed using programming software. When programming flash memory, also connect VCC, GND, and RES#.

The MD pin must be connected to debug a ROM-less product of the RX631 Group.

If the hot plug-in facility is to be used, connection to the emulator must be with the TRST# and EMLE signals for the emulator at the low and high levels, respectively, when power is supplied to the user system (at the time of a system reset). Ensure that a ceramic capacitor (approx. 0.1 μ F) is installed between the RES# pin and GND and the TRST# signal is pulled down, and include circuitry which can switch the EMLE signal to the high or low level.

2.4.4. FINE Interface Connection (RX63x and RX64x Groups) between the 14-pin connector

Figure 2.11 shows a recommended circuit for connection between the 14-pin connector and the RX63x or RX64x Group MCUs in FINE Interface Connection.

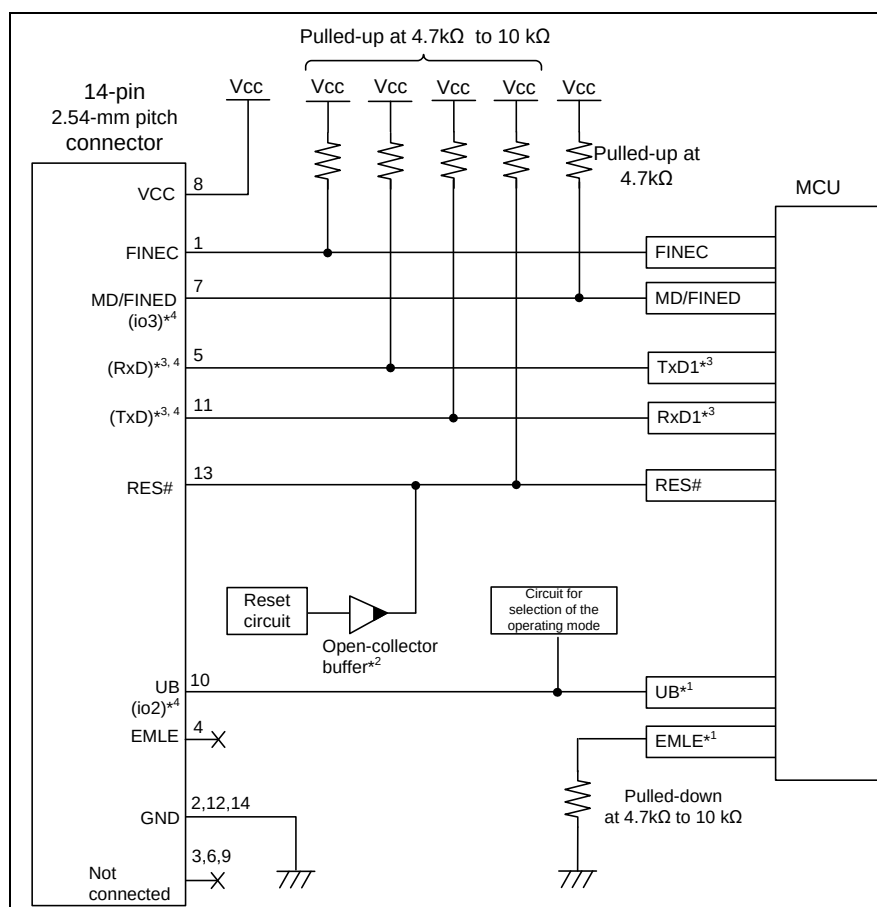


Figure 2.11 Recommended Circuit for Connection between the 14-Pin Connector and the RX63x or RX64x Group MCUs in FINE Interface Connection

- Notes:
1. For processing of signals MD, UB and EMLE, refer to section 2.5, Notes on Connection.
 2. The output of the reset circuit of the user system must be open collector.
 3. Rx/D1 and Tx/D1 signals are NOT required for debugging. These are only used for internal flash programming with Renesas Flash Programmer.
 4. The names in parentheses () are pin names in the E1 and E20 14-pin connector when flash memory is programmed using programming software. When programming flash memory, also connect VCC, GND, and RES#.

2.4.5. FINE Interface Connection (RX200 Series) between the 14-pin connector

Figure 2.12 shows a recommended circuit for connection between the 14-pin connector and the RX200 Series MCUs in FINE Interface Connection.

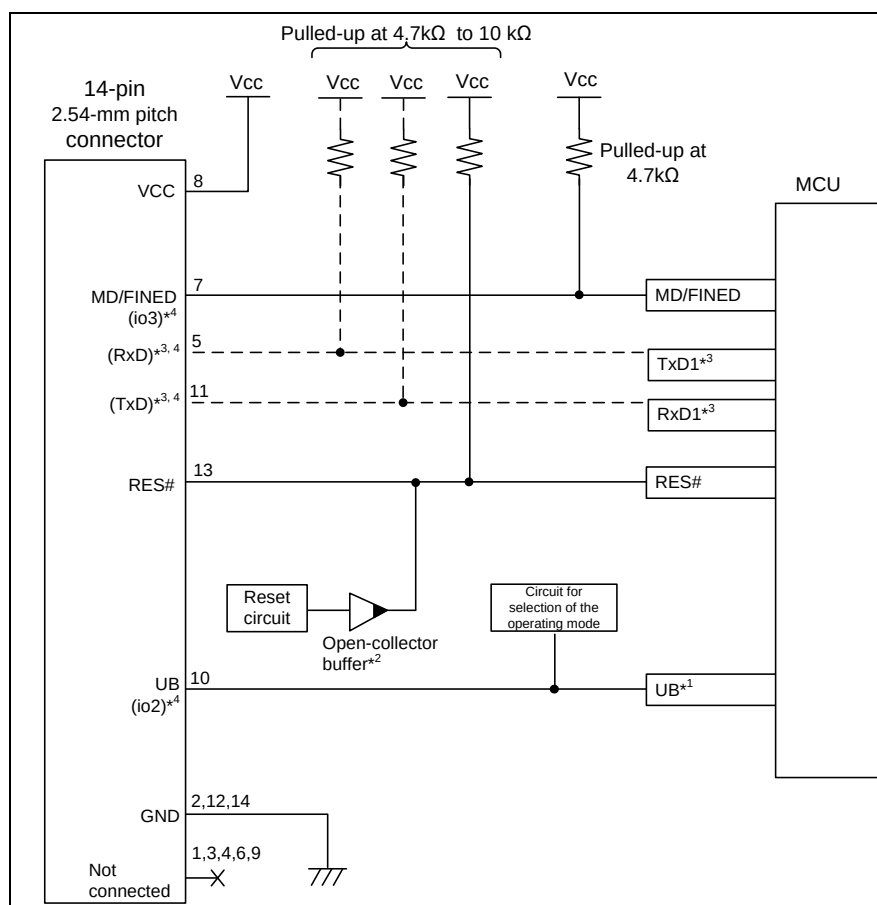


Figure 2.12 Recommended Circuit for Connection between the 14-Pin Connector and the RX200 Series MCUs in FINE Interface Connection

- Notes:
1. For processing of signals UB, refer to section 2.5, Notes on Connection.
 2. The output of the reset circuit of the user system must be open collector.
 3. Connect the Rx/D1 and Tx/D1 pins when flash memory is programmed through the SCI. When flash memory is programmed through the FINE interface, they do not need to be connected.
 4. The names in parentheses () are pin names in the E1 and E20 14-pin connector when flash memory is programmed using programming software. When programming flash memory, also connect VCC, GND, and RES#.

2.4.6. FINE Interface Connection (RX100 Series) between the 14-pin connector

Figure 2.13 shows a recommended circuit for connection between the 14-pin connector and the RX100 Series MCUs in FINE Interface Connection.

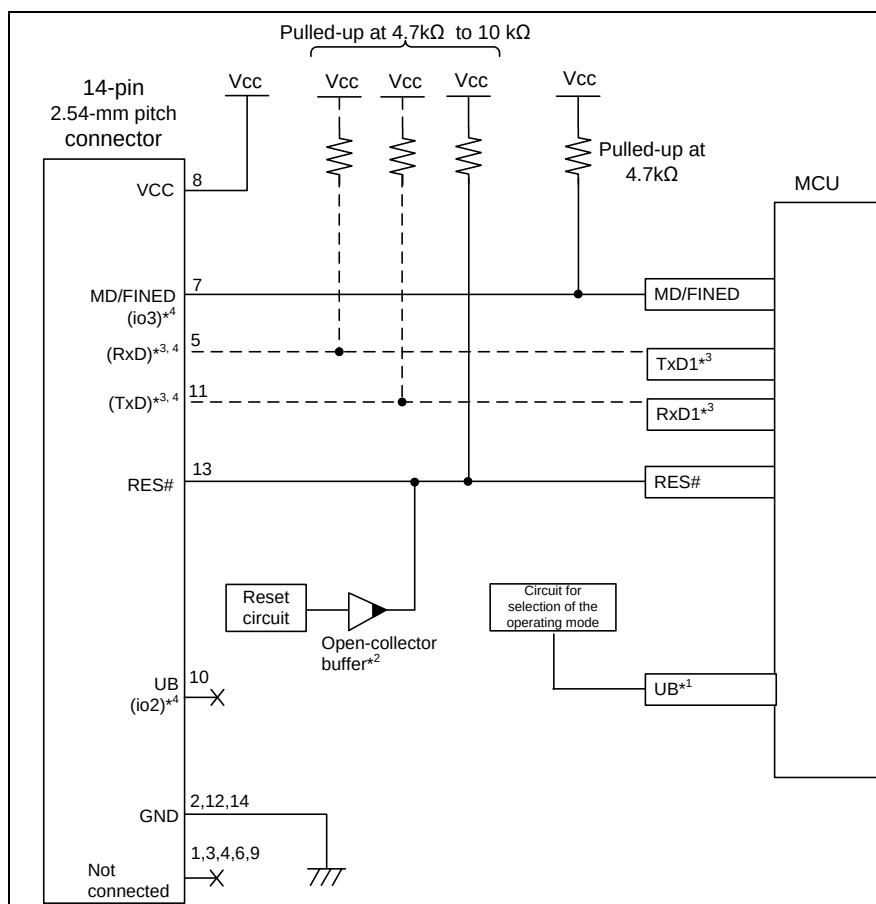


Figure 2.13 Recommended Circuit for Connection between the 14-Pin Connector and the RX100 Series MCUs in FINE Interface Connection

- Notes:
1. In RX100 Series, the UB pin connection is not required. In RX100 Series, You cannot debug a program in USB I/F mode. When debugging the RX100 Series, port for selecting the SCI I/F mode and USB I/F mode, please pull up on the user system so that the SCI I/F mode.
 2. The output of the reset circuit of the user system must be open collector.
 3. Connect the RxD1 and TxD1 pins when flash memory is programmed through the SCI. When flash memory is programmed through the FINE interface, they do not need to be connected.
 4. The names in parentheses () are pin names in the E1 and E20 14-pin connector when flash memory is programmed using programming software. When programming flash memory, also connect VCC, GND, and RES#.

2.4.7. JTAG Interface Connection (RX610, RX621, RX62N, RX62T and RX62T Groups) between the 38-pin connector

Figure 2.14 shows a recommended circuit for connection between the 38-pin connector and the RX610, RX621, RX62N, RX62T or RX62G Group MCUs in JTAG Interface Connection.

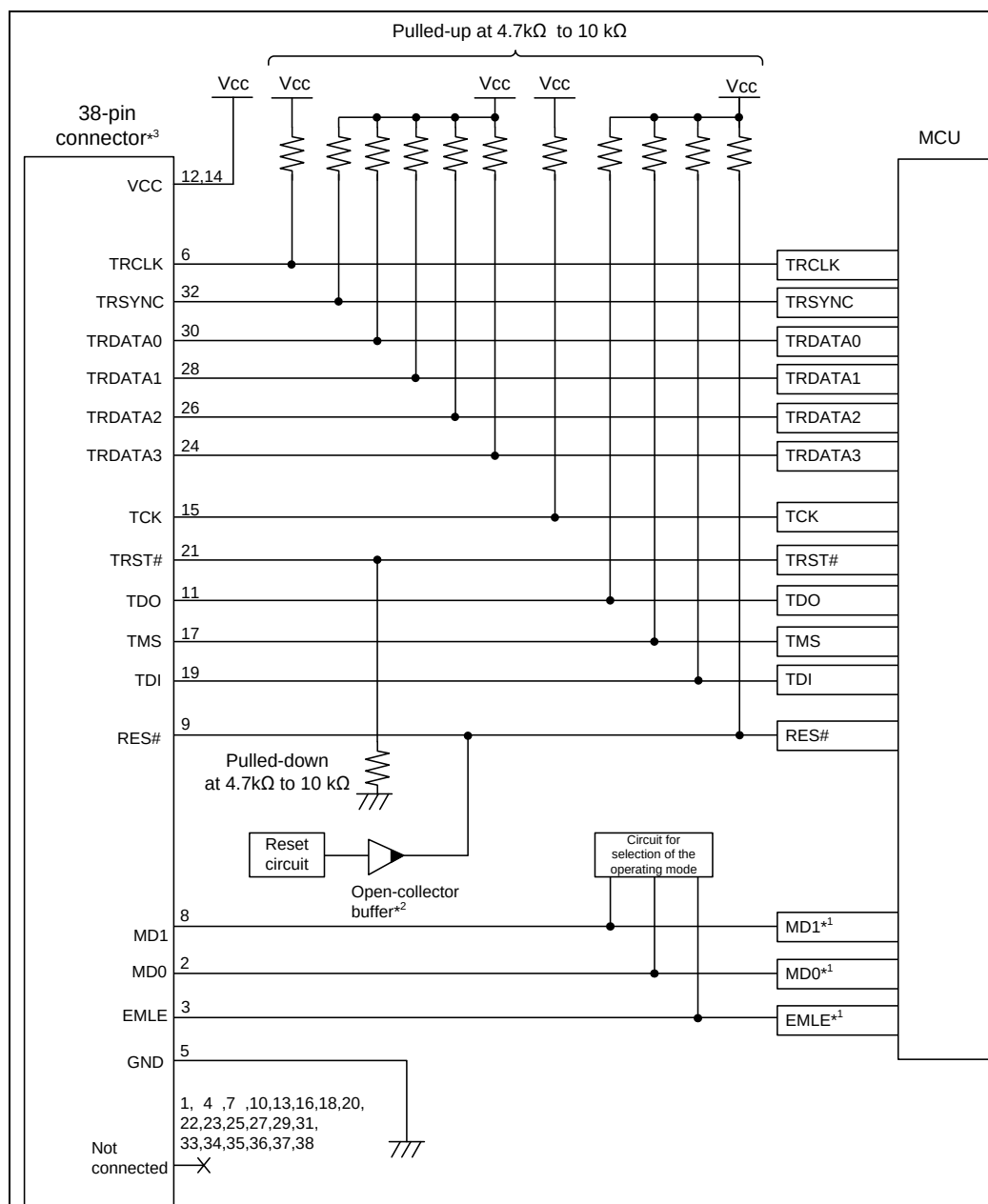


Figure 2.14 Recommended Circuit for Connection between the 38-Pin Connector and the RX610, RX621, RX62N, RX62T or RX62G Group MCUs in JTAG Interface Connection

- Notes:
1. For processing of signals MD0, MD1 and EMLE, refer to section 2.5, Notes on Connection.
 2. The output of the reset circuit of the user system must be open collector.
 3. When programming flash memory using programming software, connect the emulator connector and target MCU with reference to figure 2.7 for RX610 or figure 2.8 and figure 2.9 for RX621, RX62N, RX62T, or RX62G. When debugging, refer to figure 2.14 for the emulator connector pin numbers.

The GND bus lead at the center of the 38-pin connector must be grounded.

If the hot plug-in facility is to be used, connection to the emulator must be with the TRST# and EMLE signals for the emulator at the low and high levels, respectively, when power is supplied to the user system (at the time of a system reset). Ensure that a ceramic capacitor (approx. 0.1 μF) is installed between the RES# pin and GND and the TRST# signal is pulled down, and include circuitry which can switch the EMLE signal to the high or low level.

2.4.8. JTAG Interface Connection (RX63x and RX64x Groups) between the 38-pin connector

Figure 2.15 shows a recommended circuit for connection between the 38-pin connector and the RX63x or RX64x Group MCUs in JTAG Interface Connection.

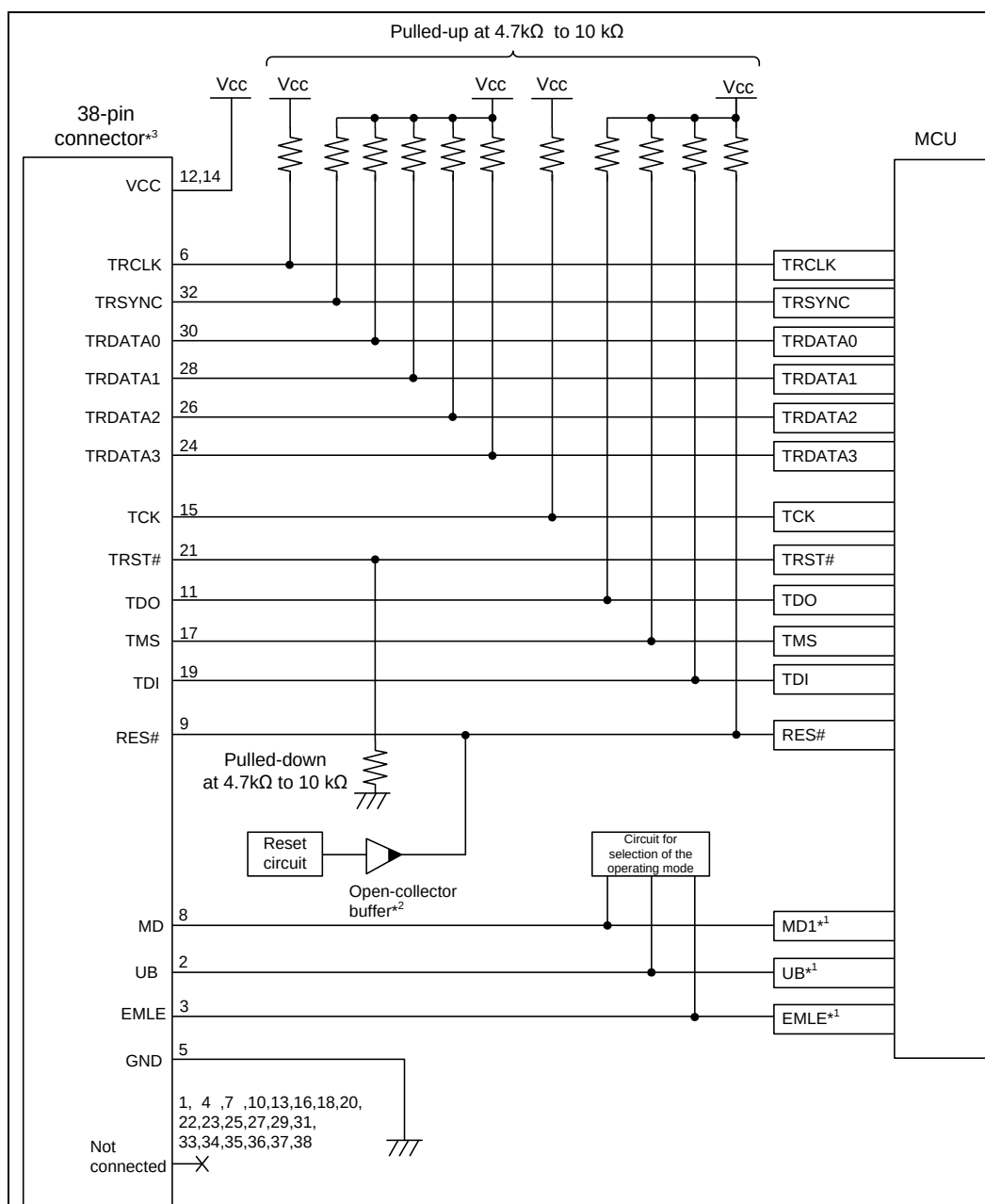


Figure 2.15 Recommended Circuit for Connection between the 38-Pin Connector and the RX63x or RX64x Group MCUs in JTAG Interface Connection

- Notes:
1. For processing of signals MD, UB and EMLE, refer to section 2.5, Notes on Connection.
 2. The output of the reset circuit of the user system must be open collector.
 3. When programming flash memory using programming software, connect the emulator connector and target MCU with reference to figure 2.10 for X63x or RX64x. When debugging, refer to figure 2.15 for the emulator connector pin numbers.

The GND bus lead at the center of the 38-pin connector must be grounded.

The MD pin must be connected to debug a ROM-less product of the RX631 Group.

If the hot plug-in facility is to be used, connection to the emulator must be with the TRST# and EMLE signals for the emulator at the low and high levels, respectively, when power is supplied to the user system (at the time of a system reset). Ensure that a ceramic capacitor (approx. 0.1 μ F) is installed between the RES# pin and GND and the TRST# signal is pulled down, and include circuitry which can switch the EMLE signal to the high or low level.

2.5. Notes on Connection

Wiring patterns between the connector and the MCU must be as short as possible (within 50 mm is recommended).

Do not connect the signal lines between the connector and MCU to other signal lines.

For the handling of pins while the E1 or E20 emulator is not in use, refer to the hardware manual for the MCU.

2.5.1. About the RES# Pin

The emulator uses the RES# pin.

If the user system includes a user logic reset circuit, the output signal from the reset circuit must be connected to the RES# pin of the connector via an open-collector buffer as shown below. If there is no reset circuit, on the other hand, the RES# pin of the connector must be directly connected to the RES# pin of the MCU.

When you use hot plug-in, install a ceramic capacitor (approx. 0.1 μ F) between the RES# pin and GND in order to suppress a noise to the RES# pin that would occur when the emulator is connected.

Hot plug-ins are not available if there is no reset circuit.

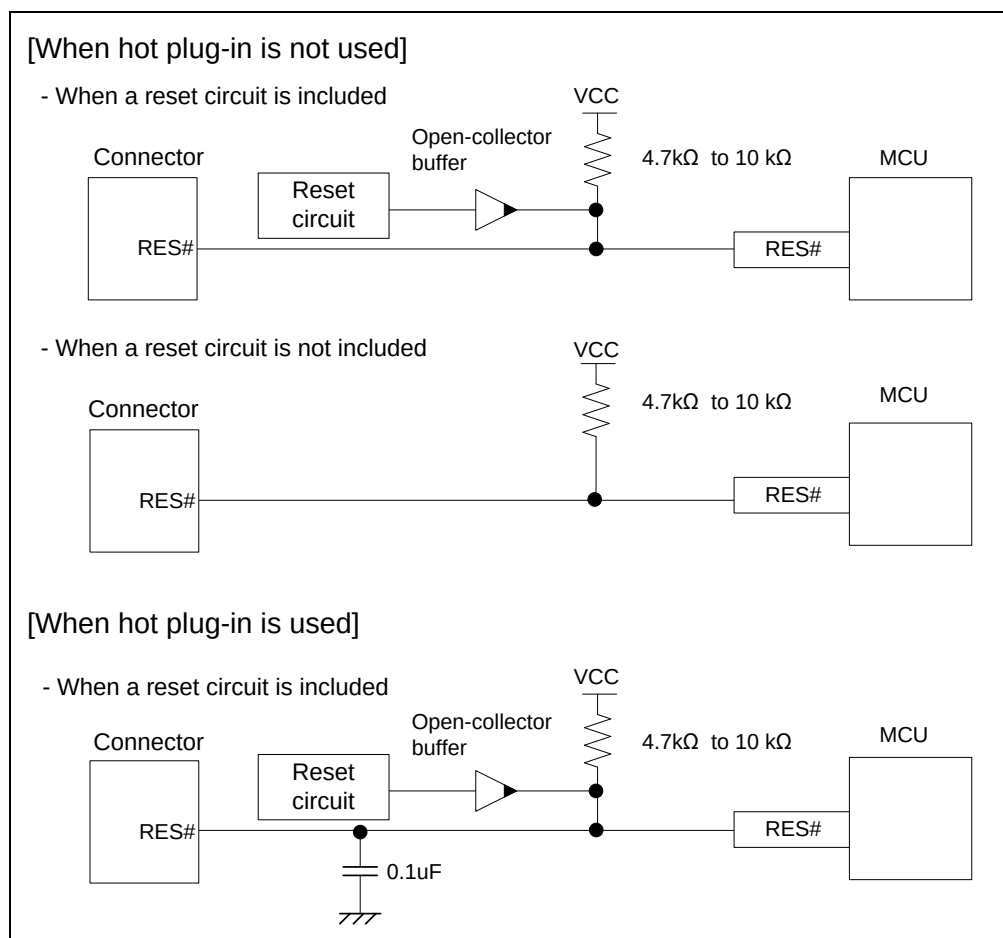


Figure 2.16 Connection of the Reset Circuit

Do not install capacitors, series resistors, or filters on signal lines; if attempted, correct communication may not be established.

2.5.2. About the EMLE Pin (JTAG Interface)

Connection of the EMLE pin to the connector is optional.

When the emulator is used with the JTAG interface and the emulator is connected, set the EMLE signal to the high level. When using the MCU without the emulator, or when rewriting the MCU by the programming software, set the EMLE signal to the low level.

When the EMLE pins of the emulator and the MCU are connected, since the level on the EMLE pin controls the emulator, the signal on the user system should be pulled down. When the EMLE pins of the emulator and the MCU are not connected, set up circuitry on the user system to switch the level on the pin between the high and low levels. If hot plug-in is to be used, ensure that the user system includes circuitry for switching the level on the EMLE pin to the high to low level, and turn the power on with the EMLE signal at the high level.

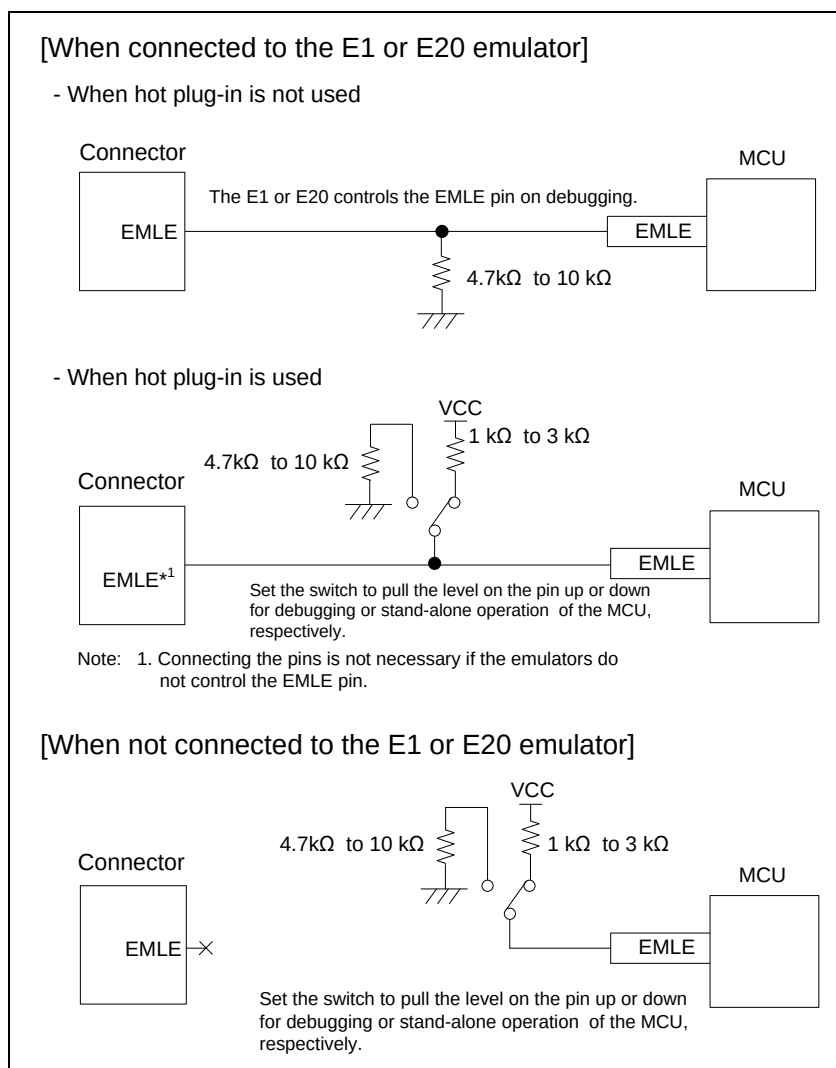


Figure 2.17 Connection of the EMLE Pin (JTAG Interface)

Do not install capacitors, series resistors, or filters on signal lines; if attempted, correct communication may not be established.

2.5.3. About the EMLE Pin (FINE Interface)

Connection of the EMLE pin to the connector is optional.

When debugging with the E1 or E20 emulator, or when using the MCU without the emulator, set the EMLE signal to the low level.

When the EMLE pins of the E1 or E20 emulator and the MCU are connected to each other, the E1 or E20 emulator operates the EMLE pin. Therefore, pull the levels on the EMLE pin down on the user system. When the EMLE pins of the E1 or E20 emulator and the MCU are not connected (e.g. when only FINE Interface Connection is used), pull the levels on the EMLE down at 4.7 kΩ to 10 kΩ on the user system.

If the MCU does not have an EMLE pin, it is not necessary to connect it to the emulator connector. In this case, only FINE Interface Connection is available.

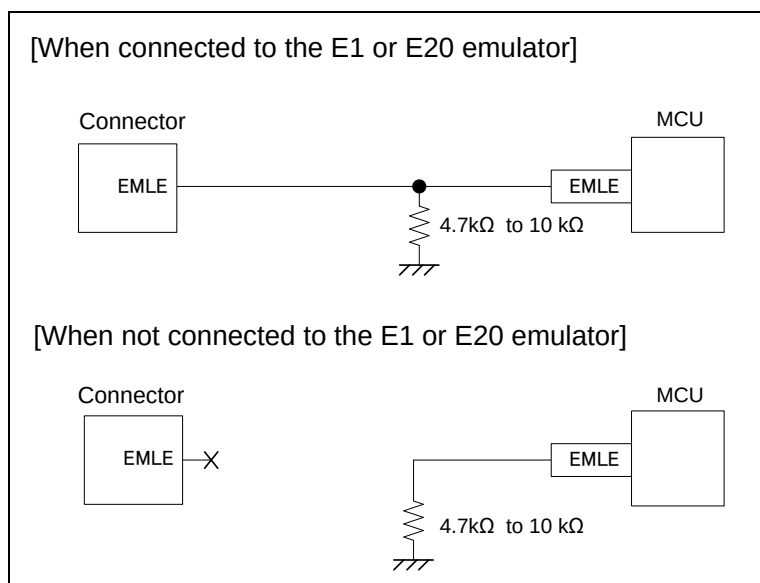


Figure 2.18 Connection of the EMLE Pin (FINE Interface)

Do not install capacitors, series resistors, or filters on signal lines; if attempted, correct communication may not be established.

2.5.4. About the MODE Pin (RX610, RX621, RX62N, RX62T and RX62G Groups, JTAG interface)

Connection of the MD0 and MD1 pins to the connector is optional.

When the MD0 and MD1 pins of the E1 or E20 emulator and the MCU are connected to each other, you can perform debugging without worrying about switching the MD0 and MD1 pins between high and low on the user system because it is done by the E1 or E20 emulator.

You cannot debug a program in boot mode.

[When the E1 or E20 emulator controls the MD0 and MD1 pins]

Pull up or pull down the MD0 and MD1 signals at 4.7 k Ω to 10 k Ω according to the operation mode of the MCU used. When programming the on-chip flash memory by using the programming software, set the programming software so a high-level signal will be output from the MD0 pin and low-level signal will be output from the MD1 pin.

[When the E1 or E20 emulator does not control the MD0 or MD1 pins]

Pull up or pull down the MD0 and MD1 signals at 4.7 k Ω to 10 k Ω according to the operation mode of the MCU used. When programming the on-chip flash memory by using the programming software, pull up the level on the MD0 pin, and pull down the level on the MD1 pin using switches.

When writing to the MCUs of the RX610, RX62T, and RX62G (112-pin version) Groups using the Flash Development Toolkit or the Renesas Flash Programmer, be aware that the pin assignments of the 14-pin connector differ than otherwise.

For details on the programming software, refer to

http://www.renesas.com/products/tools/flash_prom_programming/.

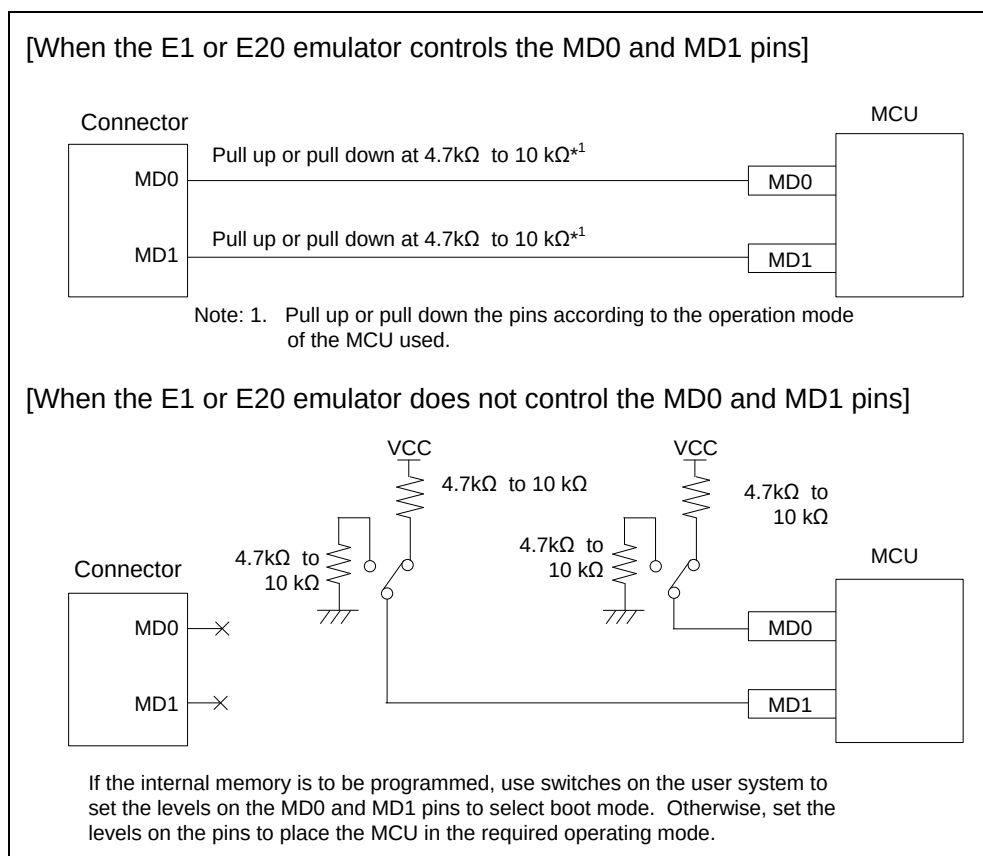


Figure 2.19 Connection of the MODE Pin to the E1 or E20 with JTAG Interface (RX610, RX621, RX62N, RX62T and RX62T Groups)

Do not install capacitors, series resistors, or filters on signal lines; if attempted, correct communication may not be established.

2.5.5. About the MODE Pin (RX63x and RX64x Groups, JTAG interface)

Connection of the MD pin to the connector is optional.

The MD pin must be connected to debug a ROM-less product of the RX631 Group.

When the MD pin of the emulator and the MCU are connected, it is possible to debug without concern for MD pin switching on the target system because the emulator controls the mode pin.

You cannot debug a program in boot mode.

[When the E1 or E20 emulator controls the MD pin]

Process the MD pin according to the operation mode of the MCU used. Pull up the MD signal at 4.7 k Ω or pull down the signal at 4.7 k Ω to 10 k Ω . When programming the on-chip flash memory by using the programming software, set the programming software so a low-level signal will be output from the MD pin.

[When the E1 or E20 emulator does not control the MD pin]

Process the MD pin according to the operation mode of the MCU used. Pull up the MD signal at 4.7 k Ω or pull down the signal at 4.7 k Ω to 10 k Ω . When programming the on-chip flash memory by using the programming software, pull down the MD signal using switches.

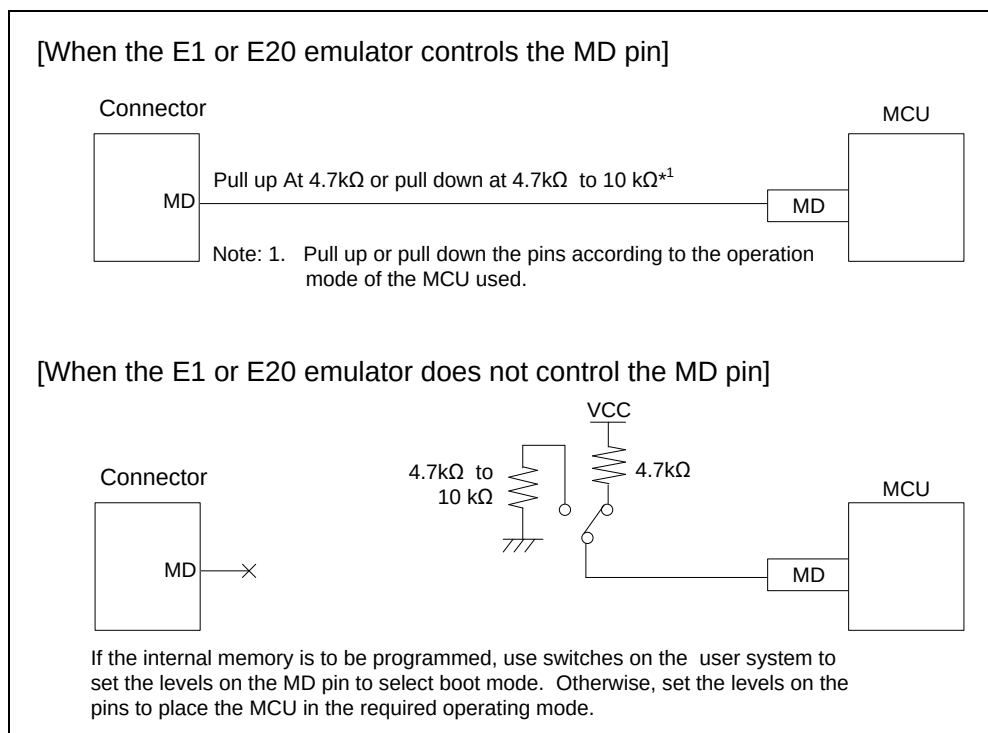


Figure 2.20 Connection of the MODE Pin to the E1 or E20 with JTAG Interface (RX63x and RX64x Groups)

Do not install capacitors, series resistors, or filters on signal lines; if attempted, correct communication may not be established.

2.5.6. About the MODE Pin (RX63x and RX64x Groups, RX200 Series and RX100 Series, FINE interface)

The MD/FINE pin must be connected to the connector as it is used as a communication channel.

Do not install capacitors, series resistors, or filters on signal lines; if attempted, correct communication may not be established.

2.5.7. About the USER BOOT Pin

It is optional to connect a pin for entry to the user boot mode (UB pin) to the connector. Which port is the UB pin depends on the MCU. Refer to the section on operation modes in the hardware manual of the MCU to be used.

Connection is not necessary if the MCU does not support the user boot mode.

When the UB pins of the E1 or E20 emulator and the MCU are connected to each other, you can perform debugging without worrying about switching the UB pin between high and low on the user system because it is done by the E1 or E20 emulator. Note that if the MCU supports a USB boot, the UB pin cannot be used as a port because it must be controlled by the emulator. If the MCU does not support a USB boot, the UB pin can be used as a port, instead of being connected to the emulator, as far as a user boot is not used. In this case, set the UB code so that a user boot is disabled.

[When the E1 or E20 emulator controls the UB pin]

You can debug a program in user boot mode.

Pull up or pull down the UB signal at 4.7 k Ω to 10 k Ω according to the operation mode of the MCU used.

When programming the on-chip flash memory by using the programming software, set the programming software so a low-level signal will be output from the UB pin.

[When the E1 or E20 emulator does not control the UB pin]

You cannot debug a program in user boot mode

Pull up or pull down the UB signal at 4.7 k Ω to 10 k Ω according to the operation mode of the MCU used.

When programming the on-chip flash memory by using the programming software, pull down the UB signal using a switch.

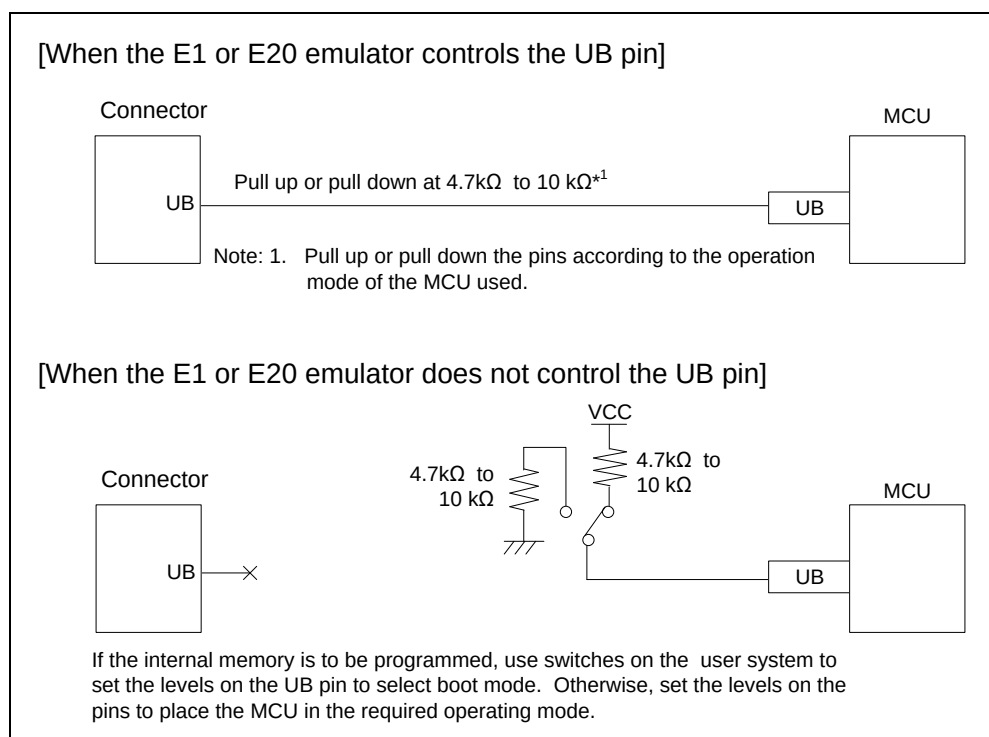


Figure 2.21 Connection of the USER BOOT Pin

Do not install capacitors, series resistors, or filters on signal lines; if attempted, correct communication may not be established.

2.5.8. About TCK, TDO, TMS and TDI Pins

In JTAG Interface Connection, the emulator uses the TCK, TDO, TMS, and TDI pins. Any functions that are multiplexed on these pins are not available.

Make the lengths of the signal lines for the JTAG pins (TCK, TMS, and TDI) as uniform as is possible (keeping the variation within 20 mm is recommended). The wiring run for the TDO pin must be the shortest. Pull up the signals of these pins at 4.7k Ω to 10k Ω and do not arrange these signal lines in parallel with or across other high-speed signal lines.

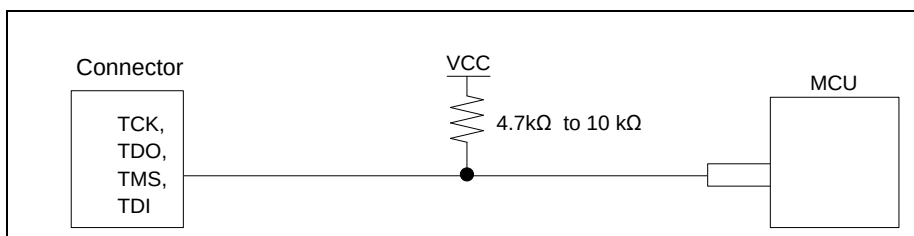


Figure 2.22 Connection of the TCK, TDO, TMS, and TDI Pins

Do not use adjacent resistors for pull-up of the TCK pin because they may affect or may be affected from other pins.

For the TCK pin, add a grounded guard ring to the pattern between the connector and the MCU.

Do not install capacitors, series resistors, or filters on signal lines; if attempted, correct communication may not be established.

2.5.9. About the TRST# Pin

In JTAG Interface Connection, the emulator uses the TRST# pin. Any functions that are multiplexed on this pin are not available. Pull down the TRST# signal at 4.7 k Ω to 10 k Ω .

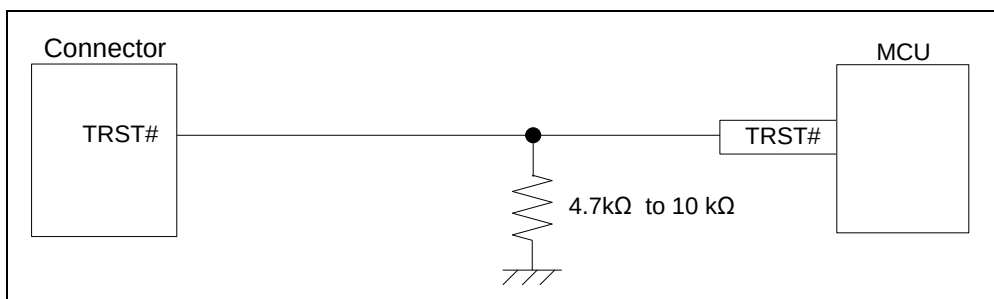


Figure 2.23 Connection of the TRST# Pin

Do not install capacitors, series resistors, or filters on signal lines; if attempted, correct communication may not be established.

2.5.10. About the FINEC and MD/FINED Pins

For the RX63x Group, FINE interface only supports a 2-wire system using FINEC and MD/FINED pins.

In FINE Interface Connection, the emulator uses the FINEC and MD/FINED pins. Any functions that are multiplexed on the FINEC pin are not available.

For the RX200 Series and RX100 Series, FINE interface supports a 1-wire system using the MD/FINED pin.

Only the MD/FINED pin is exclusively used by the E1 or E20 emulator. It is not necessary to connect the FINEC pin since this pin is not used. The FINEC pin can be used as a port.

Pull up the MD/FINED signal at 4.7 k Ω . Pull up the FINEC signal at 4.7 k Ω to 10 k Ω . Do not arrange these signal lines in parallel with or across other high-speed signal lines.

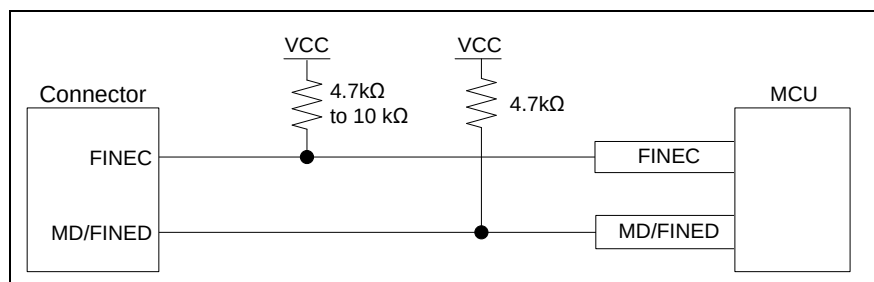


Figure 2.24 Connection of the FINEC and MD/FINED Pins to the E1 or E20

Do not use adjacent resistors for pull-up of the TCK pin because they may affect or may be affected from other pins.

For the FINEC pin, add a grounded guard ring to the pattern between the emulator connector and the MCU.

Do not install capacitors, series resistors, or filters on signal lines; if attempted, correct communication may not be established.

2.5.11. About the TRCLK, TRSYNC, and TRDATA0 to TRDATA3 Pins

The TRCLK, TRSYNC, and TRDATA0 to TRDATA3 pins are intended for the acquisition of large amounts of trace data when the E20 is in use with a 38-pin connector. The trace signals (TRCLK, TRSYNC, and TRDATA0 to TRDATA3) operate at high speed. Make the lengths of these signal lines as uniform as is possible (keeping the variation within 10 mm is recommended). Do not split the signal lines or wire any other signal line close to these lines and make the lines as short as possible. Pull up the TRCLK, TRSYNC, and TRDATA0 to TRDATA3 signal at 4.7 k Ω to 10 k Ω . Do not arrange these signal lines in parallel with or across other high-speed signal lines.

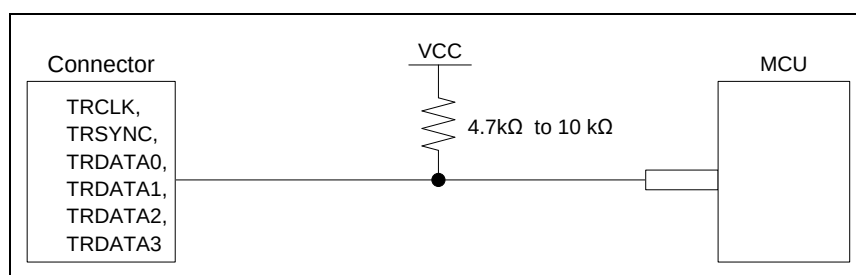


Figure 2.25 Connection of the Trace Pins to the E20

Trace signals (TRCLK, TRSYNC, and TRDATA0 to TRDATA3) operate at high speed. Do not place any devices that will produce noise over these lines.

For the TRCLK pin, add a grounded guard ring to the pattern between the connector and the MCU.

Do not install capacitors, series resistors, or filters on signal lines; if attempted, correct communication may not be established.

2.5.12. About GND

The pins of the connector marked "GND" must be at the same ground level as the VSS pin of the MCU.

2.5.13. About VCC

Connect the VCC of the connector to the VCC (power supply) of the user system.

Use the emulator within the power supply voltage of 1.8V to 5.5V and within the operating voltage range of the MCU.

When power is supplied to the user system from other than the emulator, E1/E20 emulator consumes the power supply for the last output and first input buffers of the emulator.

E1 emulator	: 3.3V approximately 20mA , 5.0V approximately 40mA
E20 emulator	: 3.3V approximately 40mA , 5.0V approximately 100mA

The E1 emulator can supply power to a simple evaluation system. Up to 200 mA current can be supplied.

When using the power supply function of the E1 emulator, check the voltage supplied to the user system. Particularly, when the 5.0V supply option is selected, the voltage may drop 0.5V or more since it depends on the USB VBUS power supply voltage.

Power supply from the E1 emulator depends on the quality of the USB power supply of the host machine, and as such, precision is not guaranteed. When writing a program that requires reliability, do not use the power supply function of the E1 emulator. Use a stable, separate power supply for the user system. When writing a program for mass production processes, use the Flash Development Toolkit or the Renesas Flash Programmer.

For details on the programming software, refer to

http://www.renesas.com/products/tools/flash_prom_programming/.

Since the internal debugging circuit is operating, when the MCU is changed to low power consumption modes, the electric current consumption values increase than DC Characteristics of the MCU.



WARNING

Warning for Turning the Power On/Off:

When supplying power, ensure that there are no shorts between Vcc and GND. Only connect the E1 or E20 after confirming that there are no mismatches of alignment on the user system port connector. Incorrect connection will result in the host machine, the emulator, and the user system emitting smoke or catching fire.

2.6. Internal Circuits of the Emulator

2.6.1. Internal Circuits of the E1 Emulator (RX600 series, JTAG Interface Connection)

Figure 2.26 show the internal circuits of the E1 emulator differing with RX600 series JTAG Interface Connection.

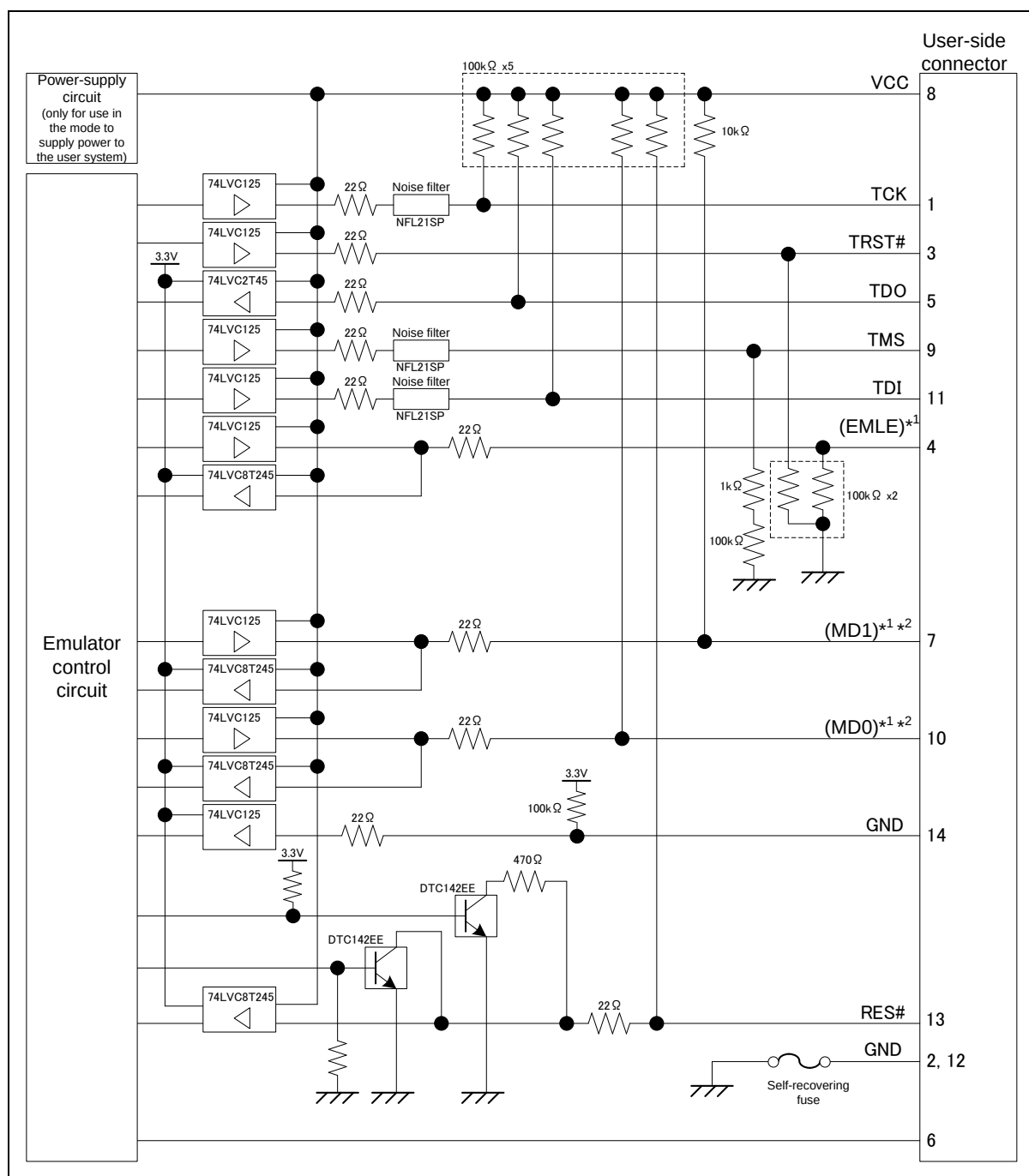


Figure 2.26 Internal Circuit of the E1 Emulator in JTAG Interface Connection (RX600 Series)

- Notes:
1. The signals marked with () operate even if they are not connected to the user system.
 2. When using MCUs of RX63x and Rx64x Groups, read "MD1" pin as "MD" pin, and "MD0" pin as "UB" pin.

2.6.2. Internal Circuits of the E1 Emulator (RX63x and Rx64x Groups, FINE Interface Connection)

Figure 2.27 show the internal circuits of the E1 emulator differing RX63x and Rx64x Groups FINE Interface Connection.

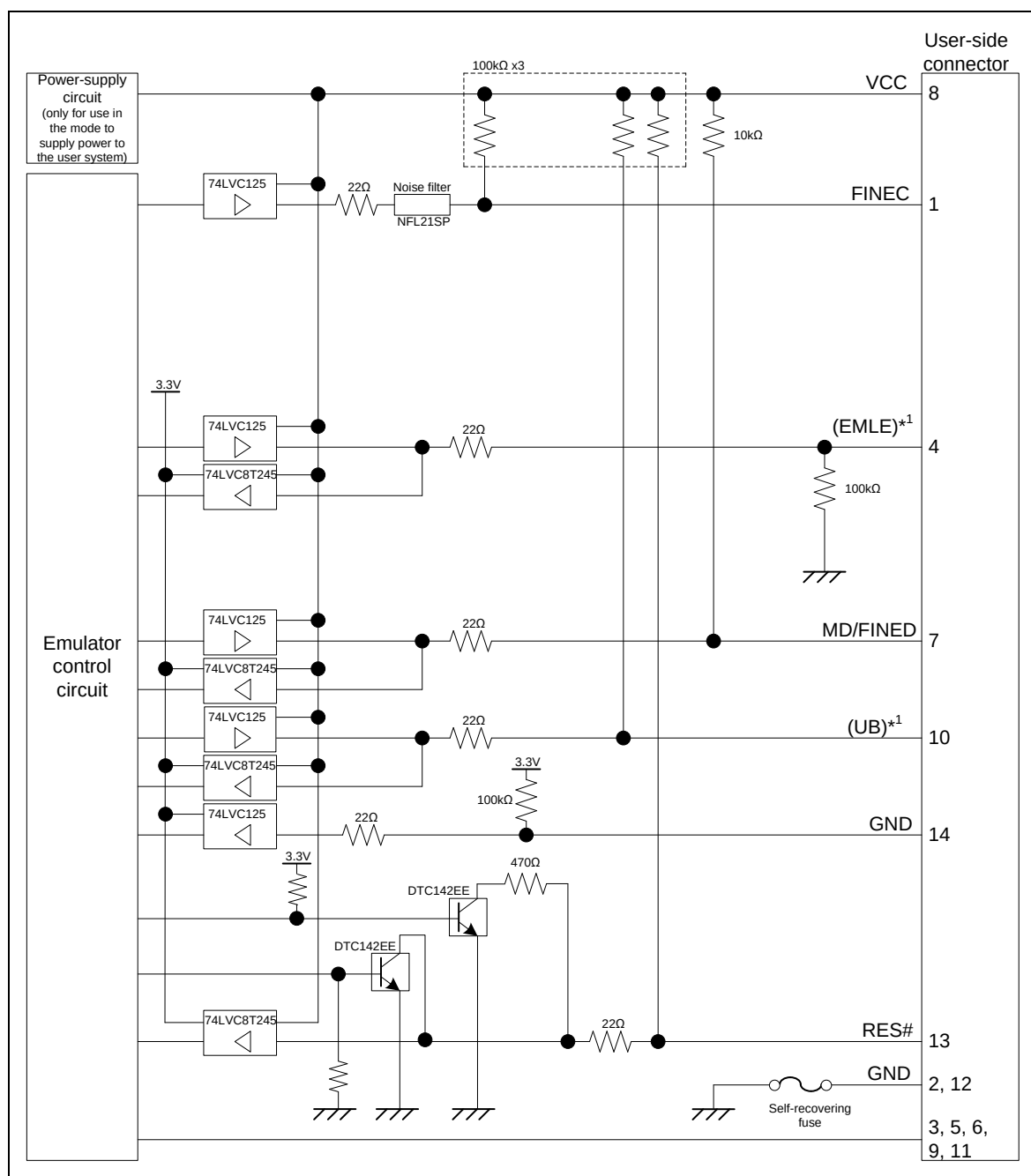


Figure 2.27 Internal Circuit of the E1 Emulator in FINE Interface Connection (RX63x and Rx64x Groups)

Notes: 1. The signals marked with () operate even if they are not connected to the user system.

2.6.3. Internal Circuits of the E1 Emulator (RX200 Series and RX100 Series, FINE Interface Connection)

Figure 2.28 show the internal circuits of the E1 emulator differing with RX200 Series and RX100 Series FINE Interface Connection.

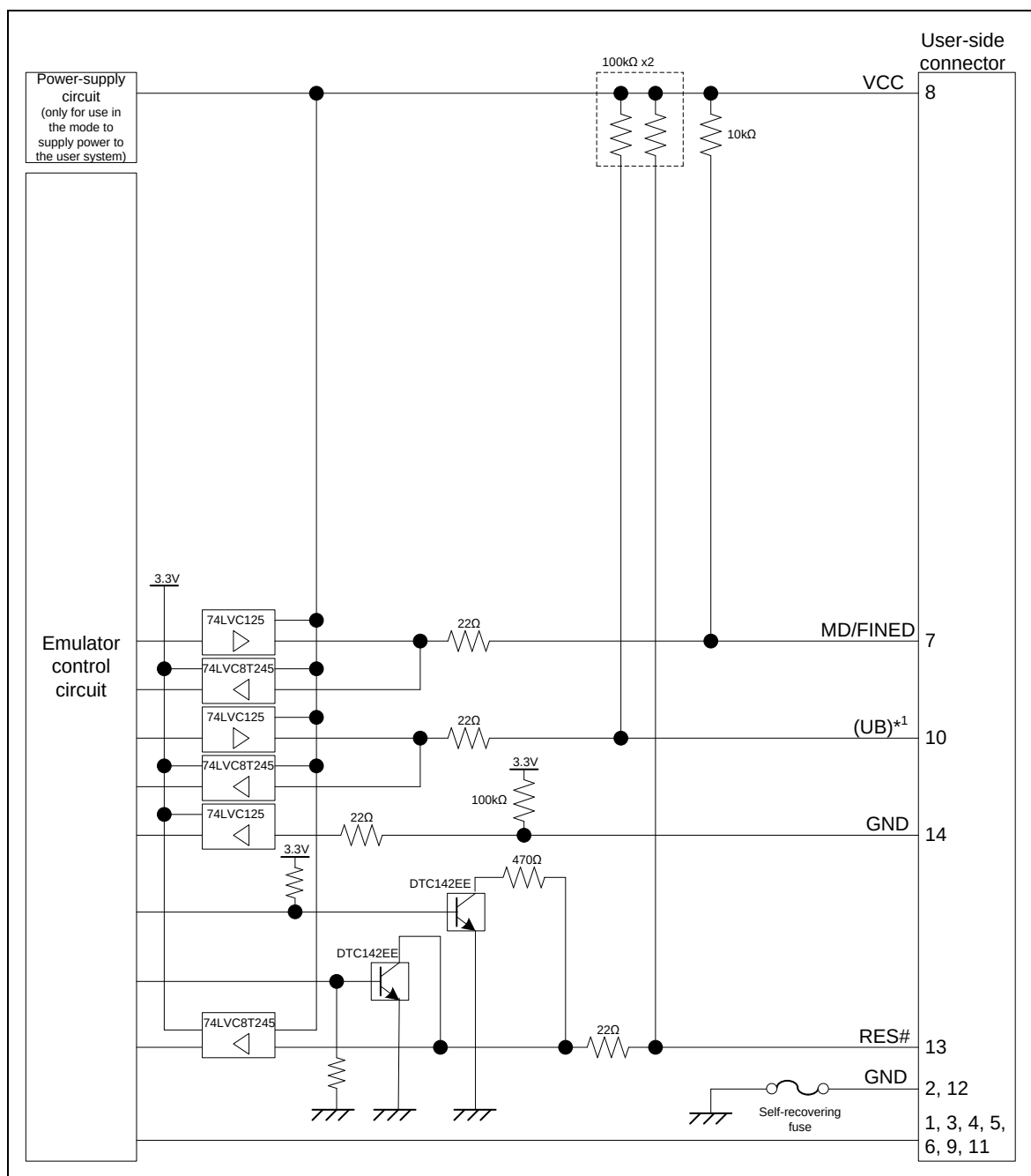


Figure 2.28 Internal Circuit of the E1 Emulator in FINE Interface Connection (RX200 Series and RX100 Series)

Notes: 1. The signals marked with () operate even if they are not connected to the user system.

2.6.4. Internal Circuits of the E20 Emulator (RX600 series, JTAG Interface Connection)

Figure 2.29 show the internal circuits of the E1 emulator differing with RX600 series JTAG Interface Connection. Also, Figure 2.30 shows the internal circuit of the E20 emulator (tracing circuit section).

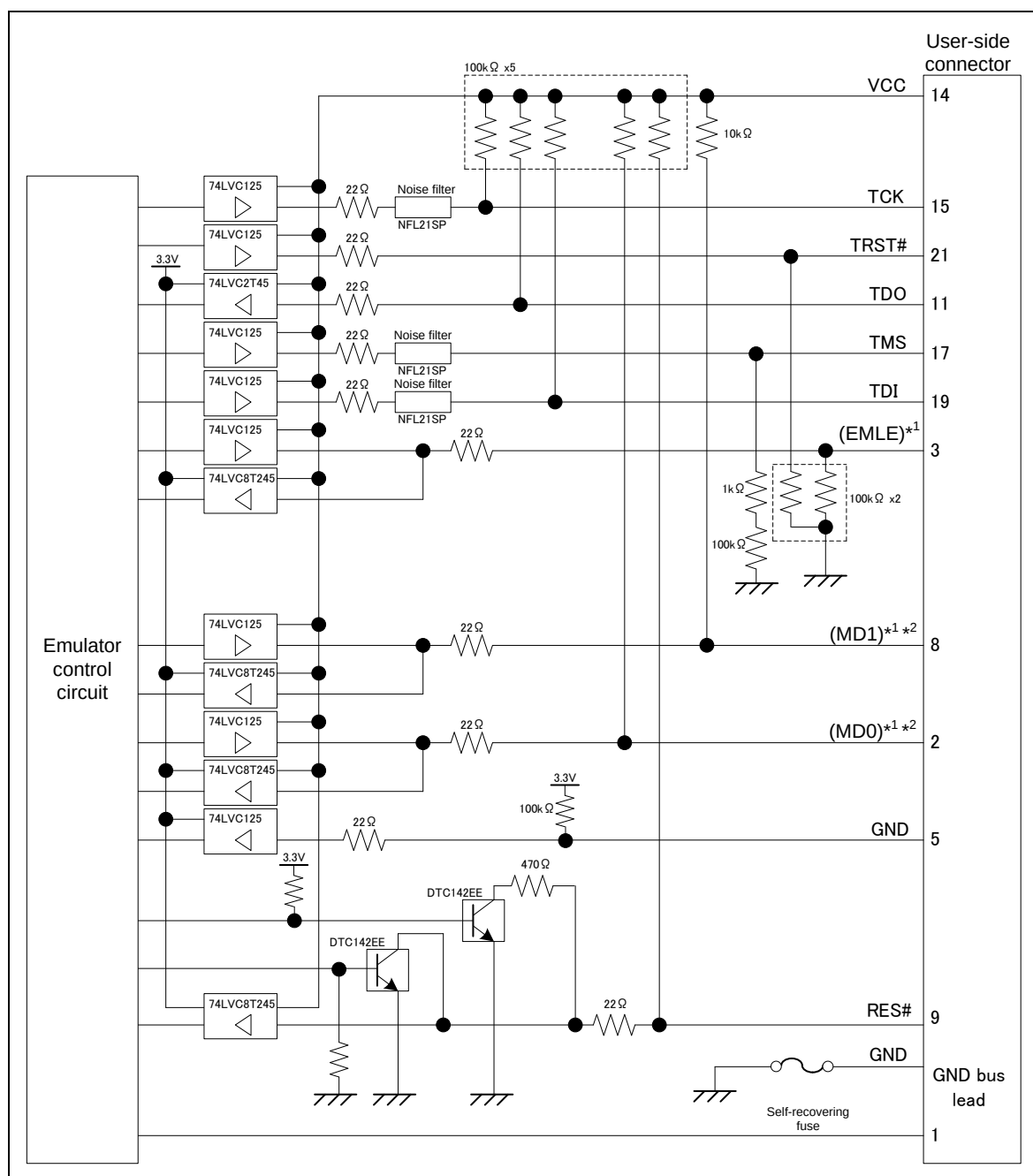


Figure 2.29 Internal Circuits of the E20 Emulator when Connecting with JTAG Interface (RX600 Series)

- Notes:
1. The signals marked with () operate even if they are not connected to the user system.
 2. When using MCUs of RX63x and Rx64x Groups, read "MD1" pin as "MD" pin, and "MD0" pin as "UB" pin.

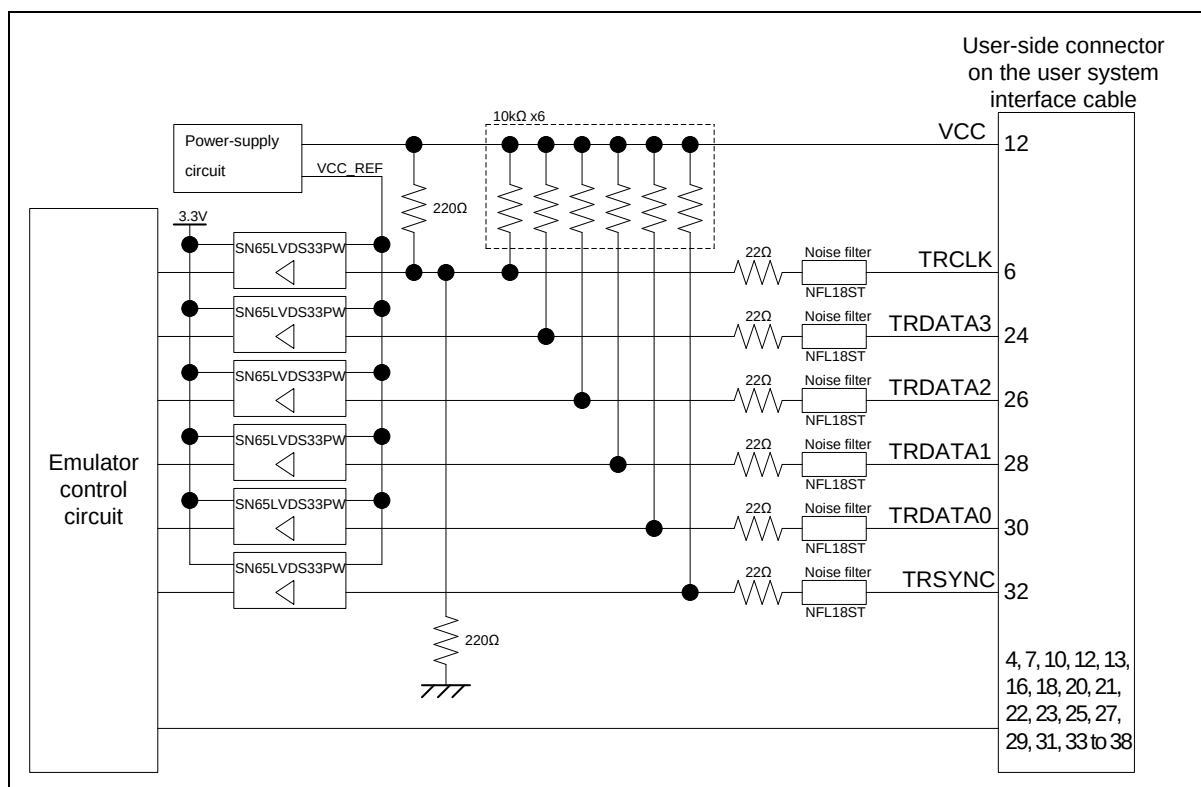


Figure 2.30 Internal Tracing Circuits of the E20 Emulator

2.7. Notes on Designing the User System

2.7.1. JTAG chain connection

The E1/E20 emulator does not support JTAG chain connections. When developing user systems, do not connect the TDI and TDO signals of the device to the boundary scan loop, or separate them by using a switch.

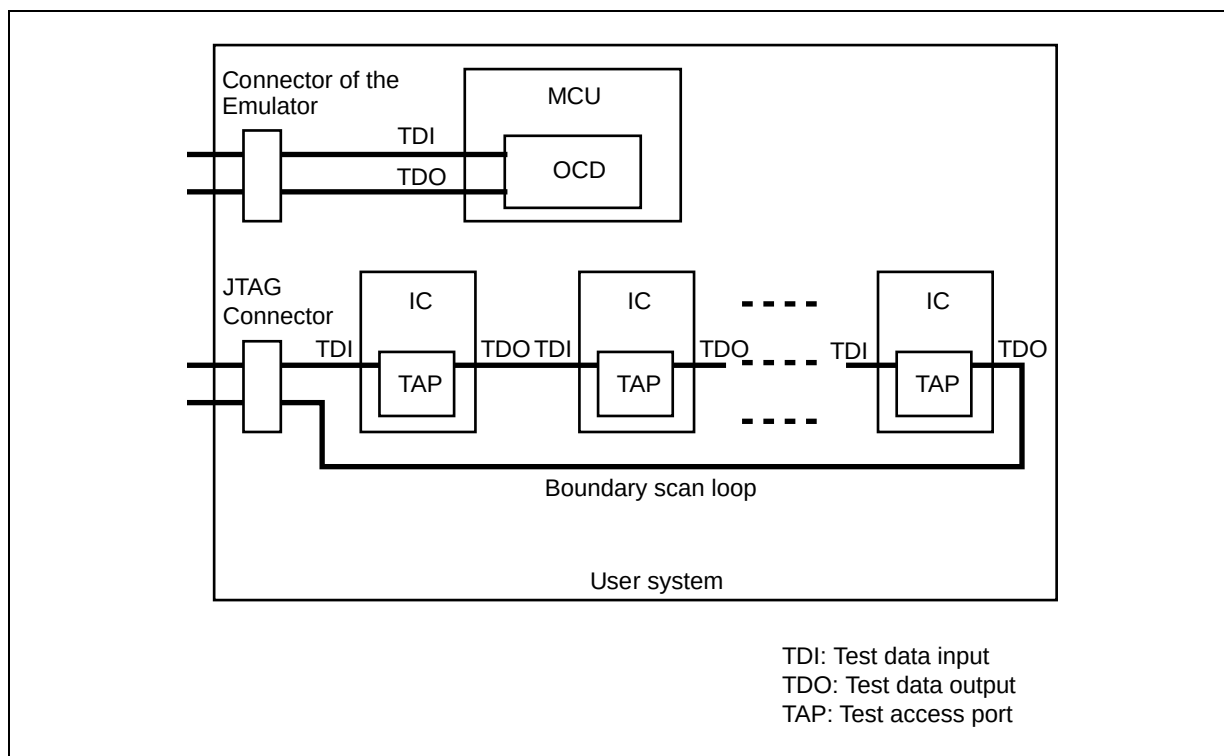


Figure 2.31 Notes on Designing the User System

2.7.2. Isolators for the E1 and E20 Emulators

For a debugging environment where there is a GND gap between the user system and host PC, use the isolator for the E1 emulator (R0E000010ACB10) or the isolator for the E20 emulator (R0E000200ACB10) that are separately available from Renesas.

2.7.3. Small Connector Conversion Adapter for the E1 Emulator

The small connector conversion adapter for the E1 emulator (R0E000010CKZ11) is separately available from Renesas for a user system board which is too small to mount the 14-pin connector that is the standard connector for the E1 emulator. By using the adapter, you can reduce the area taken up by the connector mounted on your system. When you use the Small Connector Conversion Adapter for the E1 Emulator (R0E000010CKZ11) that is separately available from Renesas, be aware that the connector pin assignments differ from those of the E1 emulator's standard interface connector. The 14-pin connector pin assignments when the Small Connector Conversion Adapter for the E1 Emulator is used are shown in Table 2.7.

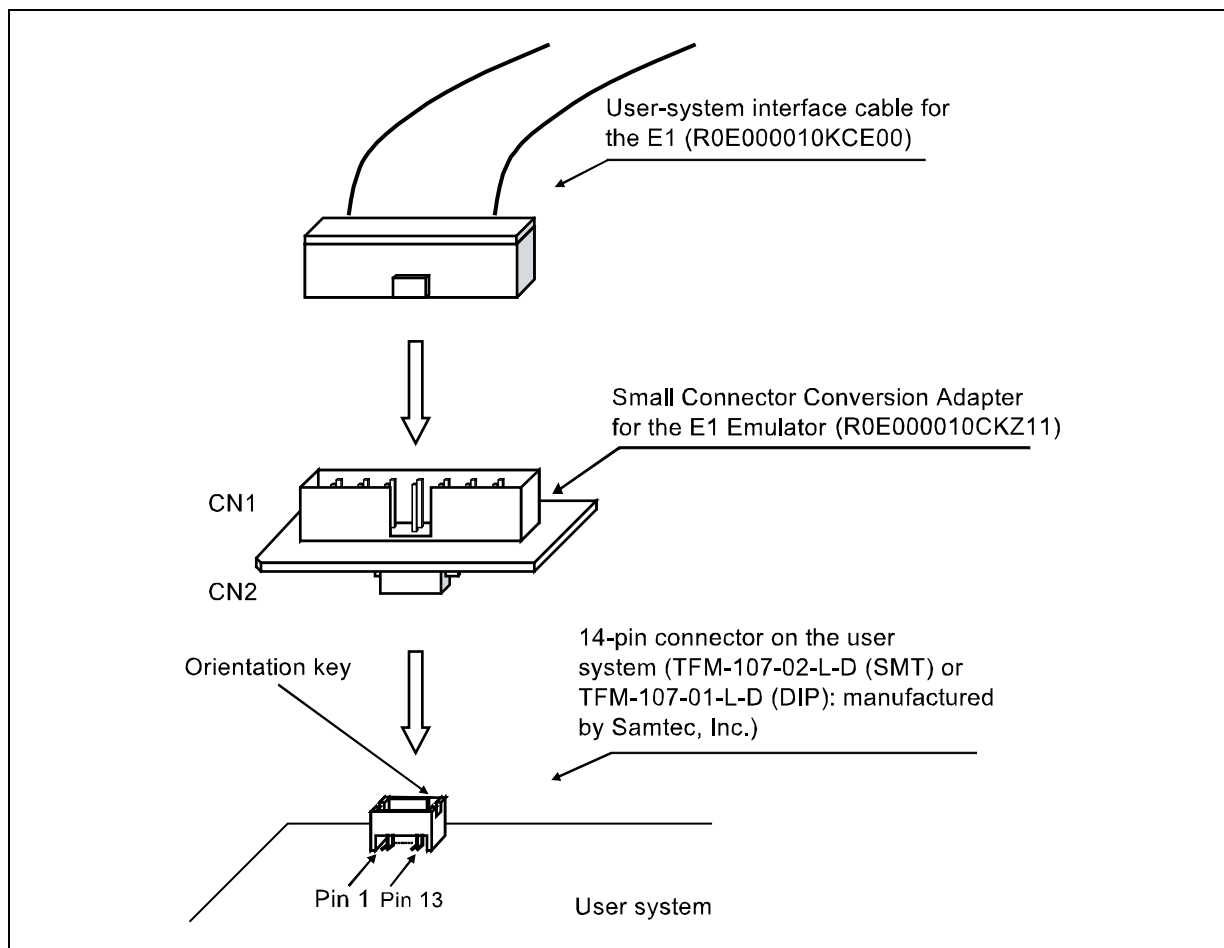


Figure 2.32 Usage of the Small Connector Conversion Adapter for the E1 Emulator

Table 2.7 Connector Pin Assignments when Small Connector Conversion Adapter for the E1 Emulator is Used

Pin No.	JTAG interface		FINE interface		Note
	Signal *1 *2	Direction *3	Signal *1 *2	Direction *3	
1	GND *4	—	GND *4	—	
2	(MD1)/(MD) *6	I/O	MD/FINED *8	I/O	
3	VCC	—	VCC	—	Power supply
4	TCK	Input	FINEC *8	Input	
5	RES#	I/O	RES#	I/O	User system reset
6	GND *4	—	GND *4	—	Checking connection to user system
7	(MD0)/(UB) *6/*7	I/O	(UB) *7	I/O	
8	TRST#	Input	NC	—	
9	TDI	Input	(RxD1) *9	Input	
10	TDO	Output	(TxD1) *9	Output	
11	(EMLE) *5	I/O	(EMLE) *5	I/O	
12	NC	—	NC	—	Not connected
13	TMS	Input	NC	—	
14	GND *4	—	GND *4	—	

- Notes:
- When writing to the MCUs of the RX610, RX62T, and RX62G (112-pin version) Groups using the Flash Development Toolkit or the Renesas Flash Programmer, be aware that the pin assignments of the 14-pin connector differ than otherwise.
For details on the programming software, refer to http://www.renesas.com/products/tools/flash_prom_programming/.
 - These are the names of the MCU pins at the time the E1 or E20 is connected (i.e. during debugging).
 - Input to or output from the user system.
 - Securely connect pins 1, 6, and 14 of the connector to GND on the user system. These pins are used as electrical GND and for the E1 or E20 to monitor connection to the user system.
 - The EMLE pin can operate even if it is not connected to the E1 or E20 emulator. When the pin is not connected to the E1 or E20 emulator, a special circuit for the pin must be configured on the user system.
If the MCU does not have an EMLE pin, it is not necessary to connect it to the emulator connector. In this case, only FINE Interface Connection is available.
 - The MD0, MD1, or MD pin can operate even if it is not connected to the E1 or E20 emulator. When the pin is not connected to the E1 or E20 emulator, a special circuit for the pin must be configured on the user system.
The MD pin must be connected to debug a ROM-less product of the RX631 Group.
You cannot debug a program in boot mode.
 - The UB pin is a port for the entry to the user boot mode. Which port is the UB pin depends on the MCU. Refer to the section on operation modes in the hardware manual of the MCU to be used.
The UB pin can operate even if it is not connected to the E1 or E20 emulator. When the pin is not connected to the E1 or E20 emulator, a special circuit for the pin must be configured on the user system.
Connection is not necessary if the MCU does not support the user boot mode.
 - For the RX63x Group, FINE interface only supports a 2-wire system using FINEC and MD/FINED pins.
The FINEC and MD/FINED pins are exclusively used by the E1 or E20 emulator. Any functions that are multiplexed on the FINEC pin are not available.
For the RX64x Group, the RX200 Series and RX100 Series, FINE interface supports a 1-wire system using the MD/FINED pin.
Only the MD/FINED pin is exclusively used by the E1 or E20 emulator. It is not necessary to connect the FINEC pin since this pin is not used. The FINEC pin can be used as a port.
 - The RxD1 and TxD1 pins are necessary when writing to flash memory via SCI. Connection is not necessary when writing via FINE or when debugging.
When debugging, the RxD1 and TxD1 pins on the emulator enter a HiZ state. If the MCU has multiple RxD1 or TxD1 pins, confirm which one of the respective pins is used in boot mode in the hardware manual of the MCU.

3. Notes on Usage

3.1. Turning the Power On/Off

Turn the power of the E1 or E20 emulator and the user system following the procedure below.

3.1.1. When a Separate Power Supply is used for the User System

<When using the emulator>

- (1) Check the power is off.
Check that the user system is turned off. When using the E20 emulator, check its power switch is off.
- (2) Connect the user system.
Connect the emulator and the user system with a user-system interface cable.
- (3) Connect the host machine and turn on the emulator.
Connect the emulator and the host machine with a USB interface cable. The E1 emulator is turned on by connecting the USB interface cable. When using the E20 emulator, turn on its power switch.
- (4) Turn on the user system.
Turn on the user system.
- (5) Launch the emulator debugger.
Launch the emulator debugger.

<When finished using the emulator>

- (1) Close the emulator debugger.
Close the emulator debugger.
- (2) Turn off the user system.
Turn off the user system.
- (3) Turn off the emulator and disconnect the emulator.
When using the E20 emulator, turn off its power switch. Disconnect the USB interface cable from the E1 or E20 emulator. The E1 emulator is turned off by disconnecting from the USB interface cable.
- (4) Disconnecting the user system.
Disconnect the user-system interface cable from the user system.



CAUTION

Notes on the User System Power Supply:



While the power of the user system is on, do not turn off the host machine, unplug the USB interface cable, or turn off the power switch of the E20 emulator.
The user system may be damaged due to leakages current.

3.1.2. When Power is supplied to the User System from the Emulator (E1 Only)

<When using the emulator>

- (1) Connect the user system.
Connect the emulator and the user system with a user-system interface cable.
- (2) Connect the host machine and turn on the emulator.
Connect the emulator and the host machine with a USB interface cable, then turn on the emulator.
- (3) Launch the emulator debugger.
Launch the emulator debugger and select the setting of power supply to the user system.

<When finished using the emulator>

- (1) Close the emulator debugger.
Close the emulator debugger.
- (2) Turn off the emulator and disconnect the emulator.
Disconnect the USB interface cable from the emulator, then turn off the emulator.
- (3) Disconnecting the user system.
Disconnect the user-system interface cable from the user system.

3.2. Power Supply Function of the E1 Emulator

When using the power supply function of the E1 emulator, check the voltage supplied to the user system. Particularly, when the 5.0V supply option is selected, the voltage may drop 0.5V or more since it depends on the USB VBUS power supply voltage.

3.3. Reset during the User Program Execution

If a pin reset or an internal reset occurs under either of the following conditions, refer to Table 3.1, showing the notes on pin resets, or Table 3.2, showing notes on internal resets. The points to note depend on the operation mode of the MCU and communication interface of the emulator.

- While the user program is being executed in the on-chip ROM disabled extended mode or user boot mode
- While the user program is being executed via FINE communication interface

Table 3.1 Notes when a Pin Reset has occurred

Groups	Interface	Operation mode	Notes when a pin reset has occurred during user program execution
RX610, RX621, RX62N	JTAG	On-chip ROM disabled extended	The reset is canceled by the emulator. Therefore, the reset timing here differs from when the actual MCU is operating singly.
RX63x, RX64x	JTAG	User boot or On-chip ROM disabled extended	
RX63x, RX64x, RX200 Series, RX100 Series	FINE	Any mode	
RX200 Series	FINE	User boot or On-chip ROM disabled extended	When a pin reset has occurred during the execution of the user system, the performance counter values and the acquired trace data are initialized.

Table 3.2 Notes when an Internal Reset has occurred

Groups	Interface	Operation mode	Notes when an internal reset has occurred during user program execution
RX610, RX621, RX62N, RX63x, RX64x	JTAG	On-chip ROM disabled extended	Debugging can be performed after the reset is canceled and the MCU operation mode is set to the on-chip ROM disabled extended mode in the user program.
RX63x, RX64x	JTAG	User boot	If an internal reset occurs, it becomes impossible to control from the emulator.
RX63x, RX64x, RX200 Series, RX100 Series	FINE	Any mode	Do not generate an internal reset such as those generated by the watchdog timer.

3.4. MCUs that are used in debugging

MCUs that are connected to the emulator and used in debugging are placed under stress by repeated programming of flash memory during emulation. Do not use MCUs that were used in debugging in mass-production for end users.

3.5. FINE communication interface

For the RX63x Group, FINE interface only supports a 2-wire system using FINEC and MD/FINED pins.

The FINEC and MD/FINED pins are exclusively used by the E1 or E20 emulator. Any functions that are multiplexed on the FINEC pin are not available.

For the RX64x Group, the RX200 Series and RX100 Series, FINE interface supports a 1-wire system using the MD/FINED pin.

Only the MD/FINED pin is exclusively used by the E1 or E20 emulator. It is not necessary to connect the FINEC pin since this pin is not used. The FINEC pin can be used as a port.

The external trace-output and real-time RAM monitoring functions via FINE interface are not supported.

Hot plug-ins via FINE interface are not supported.

3.6. High-Speed Clock Oscillator (HOCO)

The emulator uses a device's internal high-speed clock oscillator (hereafter the HOCO) to achieve communications with RX200 Series and RX100 Series MCUs. Therefore, the HOCO is always in an oscillating state no matter how the HOCO-related registers are set.

If there is a contention between switching of the HOCO frequency and memory access, the memory access operation is not guaranteed.

3.7. Final Evaluation of the User Program

Before entering the mass-production phase, be sure to perform a final evaluation of the program which is written to a flash ROM using the programming software. Be sure to perform the evaluation singly, without the E1 or E20 emulator connected.

E1/E20 Emulator
Additional Document for User's Manual
(Designing the RX User System)

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